TAMPEREEN TEKNILLINEN YLIOPISTO
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DATA-DRIVEN NEW VALUE CREATION IN SMART FARMING

Master of Science Thesis

Examiner: Prof. Miia Martinsuo

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ABSTRACT

ARNO LEHTONEN: Data-driven new value creation in smart farming
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Providing meaningful and compelling complementary services is a central element of modern product business. In business sense, the unused customer data and knowledge have a huge potential for additional customer value creation by using operational and transactional data for the benefit of customers. As markets and industries transform and boundaries between them blur, many seek a completive advantage in digital service platforms through which increased customer knowledge and insight is gathered. In turn, the data is used for the benefit of the customers through the same service platforms, enabling a form of constant dialogue between the focal company and its customers.

This thesis analyzes the service transformation with its focus on digital services and new value creation in smart farming using existing and new data sources. The research aims to assess different internal and external drivers of service creation processes from both company and customer perspectives. Additional observations of requirements and process enhancements required to create data-based digital services providing a sustainable competitive advantage are made.

Empirical research was conducted as a qualitative single-case study on an agriculture product company. The research material was gathered in semi-structured interviews with company representatives. Further observations were made during collaborative work with the case company.

The results are discussed from the case company point of view, emphasizing their internal and external development needs in enabling data-based service operations. Strategic and business model implications are discussed and answered with an action plan for the company to follow. Finally, the main research question is answered in the form of a systematic framework to enable data-based service operations. The presented framework is not industry limited but requires additional validation in different contexts.

Future research directions include various agricultural customer segments and how their needs line with different types of digital service offerings. Consumer behavior and marketing implications of supply chain data require additional research. The effects of smart farming on supply chain management processes, local food production value networks and governance issues raised by data-based service systems form a locus of research.

TIIVISTELMÄ

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Onnistuneiden lisäpalvelukokonaisuuksien tarjoaminen on olennainen osa nykyaikaista tuoteliiketoimintaa. Liiketoimintamielessä käyttämättömässä asiakasdatassa ja asiakastietämyksessä on suuri potentiaali erityisesti palvelutuotannon näkökulmasta. Palveluiden arvontuottoa asiakkaalle voitaisiin huomattavasti parantaa käyttämällä operaationaalista ja transaktionaalista dataa asiakkaiden hyödyksi. Markkinoiden ja toimialojen muuttuessa sekä niiden välisten rajojen hämärtyessä monet yritykset etsivät kilpailuetua digitaalista palvelualustoista, joiden avulla lisätään asiakas- ja toimialatietämystä. Kerättyä tietoa hyödynnetään vuorollaan asiakkaiden palvelemisessa samojen palvelualustojen kautta, avaten mahdollisuuden uudenlaiselle dialogille yrityksen ja sen asiakkaiden välille.

Diplomityössä arvioidaan älymaatalouden palveluliiketoiminnan kehittämistä digitaalisten palveluiden ja uuden arvontuoton näkökulmasta. Tutkimuksen tuloksena on arvioida erilaisten sisäisten ja ulkoisten tekijöiden vaikutusta palvelutuotantoon yrityksen sekä asiakkaiden näkökulmasta. Lisäksi tehdään selventäviä huomioita yrityksen sisäisten prosessien vaatimuksista digitaalisen, datalähtöisen palveluliiketoiminnan kehittämiseen.

Empiirinen tutkimus tehtiin kvalitatiivisena tapaustutkimuksena yritykselle, joka toimii tuotevalmistajana maatalouden sektorilla. Tutkimuksen materiaali kerättiin puolistrukturoiduissa haastatteluissa yrityksen edustajien kanssa. Lisähavaintoja tehtiin yhteistyöprojekteissa kohdeyrityksen kanssa.

Tuloksia käsitellään kohdeyrityksen näkökulmasta painottaen sisäisiä ja ulkoisia kehittämiskohteita datapohjaisen palveluliiketoiminnan kehittämisen tueksi. Strategian ja liiketoimintamallin muutoksin vastataan tarjoamalla toimintasuunnitelma seurattavaksi. Lopuksi esitetään viitekehys, joka vastaa päätutkimuskysymykseen systemaattisen datalähtöisen palvelutuotannon ja -kehityksen välineenä. Esitetty viitekehys ei ole toimialakohtainen, mutta vaatii lisätutkimusta sen validointiin eri toimialoilla.

Tulevat tutkimustarpeet sisältävät eri maatalouden asiakassegmenttien tarpeiden kartoitusta digitaalisten palveluiden kentässä. Ruuan tuotantoketjun datan vaikutus kuluttajakäyttäytymiseen ja markkinointiin vaatii lisätutkimusta. Älymaatalouden vaikutus toimitusketjun hallintaprosesseihin, lähiruoan arvoverkkoihin ja vastaukset eettisiin kysymyksiin ovat tulevan tutkimuksen keskiössä.

PREFACE

All good things must come to an end, and so is my time at TUT coming to a close as graduation looms ahead. For achieving that milestone, I would like to thank the persons who have influenced this thesis and supported me during the writing.

Special thanks are dedicated to professor Miia Martinsuo for scrutinizing my work and providing invaluable feedback throughout the writing process. Additionally, I owe thanks to Mikko Nurmi for providing a great topic and taking care of many practicalities. During this time, it has been a pleasure to work with the employees of the case company, whom I would like to thank for co-operation, discussions and taking part in the interviews. I am also grateful for the support of my family and friends.

Tampere, August 25th 2018

Arno Lehtonen

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1. INTRODUCTION

1.1 Background

In many ways, it seems that a company cannot afford not to offer services in today's competitive landscape. Customers expect services to go well along with their products, especially in consumer markets. In business-to-business markets, the situation is somewhat different, but not unlike consumers, companies value cost-effectiveness and the well-being of their investments as well. Pure physical goods simply fail to provide a sustainable competitive advantage as new value creation sources are found in services and solutions business (Oliva and Kallenberg, 2003; Froehle et al., 2000, Sheperd & Ahmed, 2000, Vargo & Lusch, 2008).

The reasons for this sea change are numerous. Researchers often conclude that the rapidly advancing technologies along with globalization have created a situation where offerings are rendered obsolete at an unprecedented rate (e.g. Chesbrough, 2007a, Froehle et al., 2000). Rising product development lead times and costs, complexity and rapidly advancing technologies add to the equation (e.g. Bauernhansl, 2014 p. 21, Chesbrough, 2007a, Sheperd and Ahmed, 2000). Additionally, increasing customer involvement and co-creating value in direct interaction can have positive effects on the customer perceived value and rates (Grönroos & Voima, 2013).

Furthermore, a commonality for both business-to-business and business-to-consumers markets is the striking rise of user experience: customers want their services to be available, modifiable and affordable at all times. The profoundly innovative ways of service design are enabled by the digitalization and use of data in new business creation, providing the much-wanted wow-factor for the user. Moreover, the things that customers value are constantly changing, and might be drastically different in the future as they are only dependent on the customer's goals and purposes (Woodruff, 1997). As such, the service creation processes need to be agile and customer-centric by nature and a dialogue between the partners in collaboration is needed to gain a mutual understanding of the value it provides to avoid creating unwanted solutions (Aarikka-Stenroos & Jaakkola, 2012).

A paradigm shift from separate products and services businesses to platforms and solutions can already be seen in form of service transformation, the effects of which are aimed to optimize activities inside the value chain of a company (Vargo & Lusch, 2008). On top of that, we are witnessing another paradigm shift with emerging new technologies such as cloud and internet of things -platforms, enabling companies to collect and analyze data

on a larger scale and complexity than ever before. As more and more devices are connected and online, high-resolution physical information can be efficiently further refined and acted on using digital tools. (Bauerhansl, 2014, p. 58)

The operating environment in business-to-business markets changed radically from pre-1990's technology push to market pull: a situation, where customer needs were deemed more important than internal efficiency (Shepherd & Ahmed, 2000). Today, the trend has continued as changing customer requirements and distribution channels create increasing qualifications for service viability. However, a lot of companies tend to neglect the strategic choices needed for effective new service generation (Froehle et al, 2000).

As a side effect, the innovative ways of using new technologies and entering new markets also diversify the ways of doing business. Hence, many companies need to re-think their market position dictated by their business model, which in end effect connects the products to the end-customers. Business models change from transactional to long term contracts and enabling those models also requires investments internally (Kindström, 2011). In marketing, new ways of co-creating value enable novel ways to extend it beyond its traditional borders (Grönroos & Voima, 2013).

1.2 Personal and company motivation

Gofore Oyj is a Tampere based software company. In the domestic market, Gofore has a strong focus on public sector customers software development and consulting. Other areas include management consulting, software architecture consulting and user experience design. Additionally, through a recent acquisition, the company has now both domestic and international large corporate customers, with a strong focus on traditional industries both in design and software. The company seeks growth in both domestic and foreign markets alike.

New digital possibilities create new means to capture customer data and get to better know their operations or behavior. In the forefront of this transformation, Gofore aims to deliver the best services and solutions for our customers. Yet, the hardest question remains: how to turn data into profit by creating new business and value for the customers? Many companies currently face this problem, a situation there would be a lot of data available, but there are little practical use cases developed on that foundation. The valuable but currently unprofitable data should be transferred to create value instead. To achieve this, additional understanding of customers' needs and capabilities is required to best serve them.

In this thesis, the focal case company is one of Gofore's customers. For them, the need that forms the context of this thesis is how to best acquire growth by creation of new digital business and how to lay a foundation for a data-based value creation process. The

case company has a vision to be a digital leader in their industry, but requires additional understanding of the adjustments they have to make during the process.

For Gofore as a company, the focus is set to find out how the company can actively support their customers in this process and co-create value with all the parties involved. In addition, as Gofore are constantly moving more and more towards a specialized service delivery house and are constantly re-thinking own business models and strategy as well, there is a need for evidence in this field.

Personally, I find the topic intriguing as it is kind of a glimpse behind the curtains in the case company. Additionally, the industry context sets an interesting point of view for the service business context. As in many traditional industries, the effects of digital transformation will be tremendous and disruptive. Through our previous projects, I have become acquainted with some of the key interviewees and I know it will be a pleasure to work with them.

1.3 Research questions and objectives

In this thesis, the focus is set in the business-to-business market in the context of agriculture industry, which offers an interesting angle to look at the challenge in a traditional setting. However, as is the case with digital, the results are applicable to any industry, as the means of creating new value based on data are ubiquitous. Additionally, efficiency gains and leveraging internal data sources for the benefit of the customer offer valuable insights for any industry.

A service and software development company lives off of their clients' success. In practice, that means that success of the company is based on the successful products and services developed by them but used and sold by customers, which creates the need to understand their processes, motivations and operating environment as well as possible. These challenges pose a research question for this thesis:

> *How can a company start to utilize operational and customer data to create new business opportunities?*

The following sub questions are also answered:

> *How does the use of customer data transform the company business model?*
> *What kind of risks, opportunities and strategical implications does it have?*

First and foremost, this thesis examines existing literature to better understand the research background of the concepts and the topic. The focus is on empirical research in industrial context. For empirical data, new insights are gathered in expert interviews and a synthesis is made to propose a course of action for the focal company. Experts from

different business units are interviewed. Finally, a review of these interviews is concluded, and a synthesis is made to review the companywide implications of digitalization needs and drivers.

As far as the theoretical part is concerned, this thesis aims to shed light on the reverse use of customer data in creating new business opportunities as a phenomenon. Additionally, means to enhance internal processes and open company data for the benefit of customers are discussed. For the focal company, the objective is to clarify the goals and needs in this business transformation process. As a result, the aim is to present a framework for data-based service creation process is presented to summarize the results.

1.4 Structure of the thesis

This thesis is divided into six parts as follows: the first part after the introduction is literature review, which aims to give a reasonable historical understanding of the phenomena this thesis deals with, ending with the latest research in the agriculture industry context. The literature review builds a comprehensive picture of the service business basics, customer value creation and co-creation, data-based services and digital services in industrial context. For this thesis, the literature review captures the essential parts of data-driven service generation currently and in the future. Furthermore, possible gaps in research are identified.

In the following third chapter, the case company and methodologies are described in detail. The case company has a vision to provide novel service concepts for its customers to use, as it would greatly increase the value provided complementing their products. However, there is a need to clarify both internal and external needs to facilitate new digital service platforms. In turn, services are hoped to capture more value in the value chain and to provide the company with a unique value proposition. Operating in a traditional industry, providing easy to use services that would be applicable to a heterogenous customer base is a challenge. The research material was gathered in semi-structured interviews with company representatives. Additional observations were made with the case company in various collaborative project environments.

Chapter 4 presents the results of the empirical study and identifies challenges, opportunities and risks found in the research material. Challenges were identified and classified by their importance. Following those results, main development areas and needs in the near future were identified and discussed further.

After that in chapter 5, results are discussed and analyzed in detail comparing empiric material with literature examples. Concrete improvement ideas that emerged during the interview sessions were assessed and clarified to provide a path of action. The main research question was answered in the form of an empirically grounded framework for data-based digital service development activities.

In the final chapter, a conclusion is presented in form of a summary of the results in a direct comparison to the literature examples discussed in the theoretical background section. Additionally, research limitations are critically examined, as this study was conducted only from the point of view of the focal company. Thus, it did not assess third party effects on the situation, following ecosystem thinking. The interviews were limited inside the company and did not offer outside expertise nor customer views on the matter, which might be problematic in the sense of customer orientation and understanding customer needs. Additional interviews and research in different industry contexts would be required to validate the results.

Finally, future research needs in light of the identified research gaps are discussed. Overall, there seems to be little research of data-based technologies, smart farming and its effect on the supply chain and consumer behavior as whole. Additionally, there is a clear need to assess different value constellations and networks as they vary greatly from country to country. Gathering vast amounts of data in different stages of supply chains also raises ethical and governance issues that must be solved.

2. LITERATURE REVIEW

2.1 Services

2.1.1 Definition of a service

Traditionally in textbook literature services were characterized by four attributes: they are intangible, heterogeneous, inseparable and perishable by nature (e.g. Parasuraman et al., 1985, Edgett & Parkinson, 1993). Intangibility implies that services cannot be felt or touched at the event of purchase. Heterogeneity denotes the fact that each transaction is a varying one, even if by a slight change. Inseparability implies that the service is inseparable from the situation where it happens, i.e. when the customer engages with the said service. Finally, services are described as perishable, as services are consumed right at the moment they are created and cannot be measured, sold or traced afterwards. (e.g. Vargo & Lusch, 2004)

Later, this view has been declared outdated and not all-encompassing (Edvardsson et al., 2005, Vargo & Lusch, 2004). In their literature review and interviews, Edvarsson et al. (2014) found that half of the experts were against the flawed and simplified definition of a service, while others found it useful to some extent. The general opinion was that the characteristics did maybe not have as much emphasis as before, making them not applicable for every situation. Additionally, they fail to recognize the co-producing nature of services, where the customer is an active part of the service creation process. E.g. Saarijärvi et al. (2014) argue that it is "during these processes and as a result of resource integration that value for the customer eventually emerges." Also Grönroos & Voima (2013) identify that direct service interactions are a mode of joint value creation.

According to Grönroos (2008), service literature has three views on services: service as an activity, service as a perspective to the customer's value creation and service as a perspective on the provider's activities. Grönroos himself (2006) defines a service as an activity as follows: "… a process that consists of a set of activities which take place in interactions between a customer and people, goods and other physical resources, systems and/or infrastructures representing the service provider and possibly involving other customers, which aims at assisting the customer's everyday practices." The former approach may have different focuses, but the notion of process in defining a service is heavily denoted. (Grönroos, 2006). The latter two definitions are not related to the activity itself, but rather shift the focus to either customers' purchasing and consumption processes and for organizations' business and marketing strategies. (Grönroos, 2008)

Counterarguing the traditional characteristics, Vargo & Lusch (2004) note that services are often tangible in their results, relatively standardized, customer involvement is also a part of physical goods and the effects or benefits last longer than just momentarily. They see that the service research paradigm has been skewed by lack of perspective, that stems from the wrong type of in many ways juxtaposition-like thinking. Many physical goods share common characteristics with the aforementioned four service characteristics. All dimensions are listed in table 1 below.

Table 1. *Traditional service characteristics debunked (adapted from Vargo & Lusch, 2004)*

Dimension	Dispelling the myth
Intangibility *Services lack the tactile quality of goods*	Services often have tangible results Tangible goods are often purchased for intangible benefits
Heterogeneity *Unlike goods, services cannot be standardized*	Tangible goods are often heterogenous Many services are relatively standardized
Inseparability *Unlike goods, services are simultaneously produced and consumed*	The consumer is always involved in the 'production' of value
Perishability *Services cannot be produced ahead of time and inventorized*	Tangible goods are perishable Many services result in long lasting benefits Both tangible and intangible capabilities can be inventorized Inventory represents an additional marketing cost

Later in their research paper, the writers define a service as an "application of specialized competences (skills and knowledge), through deeds, processes and performances for the benefit of another entity or the entity itself (self-service)". They even go as far as to suggest that everything is fundamentally a service, making the notion inclusive rather than excluding or being an opposite of goods and because of this relationship, the nature of neither can be captured on their own. (Vargo & Lusch, 2004)

2.1.2 Service transformation

The service transition has been studied in detail for a relatively long period, yet its effects have never been as profound as now. What fuels this transition? Why do even more and

more companies seek new possibilities in the service market? Traditionally, companies have offered services because they have had to. There was a need for spare parts, maintenance and other activities, all of which no other third party could provide.

According to Kindström (2011) this so called 'servitization' means that companies are not only creating accompanying services for their products but shifting their offering and whole business model towards a more service-oriented value proposition. Many manufacturing companies are testing new revenue models e.g. based on rental prices, which require additional investments in new types of activities altogether. (Kindström, 2011)

Among others, for example Vargo & Lusch (2008) present two models to depict the transition from a pure physical product maker to a service-oriented company. A company following the goods logic sees customers as targets for marketing and sales and the company focuses on making the said products. With service logic, the situation is turned around and customers become a resource for value creation: a process where using one's resources for the benefit of and in conjunction with other parties involved. The full framework and juxtaposition is presented in table 2.

Table 2. *Transition from goods to services (Vargo & Lusch, 2008)*

Goods logic	Service logic
Making something (goods or services)	Assisting customers in their own value creation processes
Value as produced	Value as co-created
Customers as isolated entries	Customers in context of their own networks
Firm resources primarily as operand	Firm resources primarily as operant
Customers as targets	Customers as resource
Primacy of efficiency	Efficiency through effectiveness

Historically, Shepherd and Ahmed (2000) noticed this tendency in the IT industry, where computer equipment manufacturers such as IBM and Texas Instruments re-positioned themselves on the market by offering services accompanying their products. This paradigm shift was caused by diminishing returns on the technology front as shorter product life-cycles became shorter and shorter: high-tech of yesteryear became a commodity quickly. Differentiation and customer loyalty were acquired by developing products tailored for their needs and by providing better support and service. (Shepherd & Ahmed, 2000)

Embracing the possibilities of value networks and inviting customers to co-create value has numerous positive effects if managed right (Dong & Sivakumar, 2017). Brax (2005) notes, that the required changes are not necessarily easy but require "motivating the customer to the service co-production." Where products can be sold as single transactions, services require active participation i.e. willingness to buy them, and thus they need to be marketed accordingly. Kindström (2011) emphasizes the ability to promote and communicate the complex service value propositions to the customer, that may require new types of promotional techniques and customer education. Another problem is the process of information management: how to log and gather customer data so that it is and remains accurate? With this added complexity, the requirements for information systems rise. On the other hand, communicating and reacting to customer's wishes becomes vital as otherwise the service offering may falsely be perceived as opportunistic behavior on the manufacturer's part. (Brax, 2005)

However, turning value concepts around has proven to be a challenge for many companies, as innovative pricing models are hard to generate. From the service innovation perspective, the focus should be kept on innovating within the offering in order to design new revenue mechanisms that fit the service-based business models. Additional concerns may be customer trust and brand image, which are more difficult to measure with services than with products. Finally, many advanced service or solution concepts require a lot of customer trust for them to use them. (Kindström, 2011)

2.2 Business model

2.2.1 Definition

Amit & Zott (2001) describe a business model as "the structure, content and governance of transactions" between a company and its exchange partners. Chesbrough (2007b) defines the business model as two main activities: value creation and value capture. The first one defines the process, the result of which creates net value through various activities. From this pool of activities, the company must capture a share of the value created, as is the fundamental goal of a business. Altogether, Chesbrough (2007b) uses six dimensions to define the business model, reflecting the various extents of the paradigm. The dimensions are presented in table 3.

Table 3. *Parts of a business model (Chesbrough, 2007b)*

Dimension	Explanation
Value proposition	The offering of a company and more precisely how that transforms into customer value
Target market	Customer segment to target: by shifting the target market, new opportunities may appear when unlocking new customers in an underserved market
Value chain	Supply chain and network management for increased efficiency and access to markets
Revenue mechanisms	How products and services are transformed into money, e.g. different pricing mechanisms
Value network or ecosystem	Finding novel ways to utilize strategic partnerships in creating value
Competitive strategy	A sustainable competitive advantage, which is hard to imitate

Chesbrough's (2007b) activity theme is reflected by Zott & Amit (2008) who claim that business models capture value by conjoining and lining up the transactions that connect the focal company with other parties. Stewart & Zhao (2000) follow a simple definition, defining business model as a "statement of how a firm will make money and sustain its profit stream over time." To summarize, Zott et al. (2011) note that often business model is studied without a definition, taking its meaning for granted and that the existing definitions only partially overlap, giving room for interpretations.

In many cases, a better business model is able to outperform rivals' technological advantage (Chesbrough, 2007b). That is especially true with novelty-based business models, which enable new ways of economic transactions among the participants. However, novelty can be pursued in many ways. Consider their example of Amazon's efficiency focus, which aims to enable consistent order tracking throughout the supply chain: not only it brings internal efficiency benefits, it also introduces a novelty factor that other competitors cannot easily reproduce. (Zott & Amit, 2008)

The context of this thesis limits the definition to the value creation mechanisms enabled by the company, its customers and the value network by choice. Additionally, for the case company, the emphasis is on value proposition and achieving a sustainable competitive

advantage by providing novel value combinations no other competitor is able to provide. Although other mechanisms are as important, they are out of the scope of this thesis. Hence, the customer value and value co-creation in direct interaction are discussed in detail and external effects and ecosystem-thinking are less emphasized.

2.2.2 Customer value

Definitions of customer value are indeed numerous and diverse. Woodruff (1997) identified some commonalities in many of the definitions, all of which identify customer value linked to the products that the customer uses. According to him, research agrees on two facts regarding customer value orientation: first, adopting this mode requires extensive knowledge of both the market and the customer and second, this knowledge needs to be transformed into products and services (Woodruff, 1997).

Grönroos' (2008) definition of customer value creation captures the essential nature of the process: "value for customers means that they, after having been assisted by the provision of resources or interactive processes, are or feel better off than before" (Grönroos, 2008). Lusch & Vargo (2006, p. 18) argue that customer becomes a resource or a co-producer rather than a target when they are involved in the value chain. Grönroos & Voima (2013) argue that value is created as potential value-in-exchange by a company in its offering and as value-in-use by a customer, utilizing a product or a service.

In business-to-business context, the process of value creation is complex by nature, as it is often hard to track down the exact division between *business effectiveness* and *operational efficiency*, where both are active drivers of value creation based on the company strategy. Operational efficiency simply means the functionality of different business processes: how orders are placed, processed and delivered. On the other hand, business efficiency is tied to the effectiveness of various practices: how the processes e.g. support revenue generation, growth or cost levels. Therefore, the customer value can be measured in monetary terms but without overseeing the additional perceived dimensions in form of trust, commitment and attraction, which cannot be analysed in monetary terms. (Grönroos, 2011a)

Thus, considering service offering creation, the supplier's support manifests itself in three forms: effects on customers's growth and revenue-generating capacity, effects on customer's cost level and effects on perceptions. The first one entails the business growth opportunities and possible higher margins, which can be a result of e.g. a successful new product offering. For the supplier, the value created is two-fold: in addition to the monetary point of view, also the perception of the supplier changes with success in form of increased customer trust, commitment and attraction (Grönroos, 2011a).

When speaking of outsourcing or co-creating services, it is always not clear how to best capture the potential value. According to Eggert et al. (2017) there remains the question

whether, how and in which situations manufacturing firms 'can realize the potential advantages of outsourcing business services'. Moreover, existing literature is limited to dyadic settings, as it approaches the situation from a supply chain perspective. When speaking of delivering value to the customers, the situation has three parties involved: the company, the service provider and the customer. Both internal and external services may be outsourced, yet the customer value delivery of internal service outsourcing is a mere indirect one. With these preconditions, the study focuses on the effects of both internal and external service outsourcing. (Eggert et al., 2017)

As well as capturing the value, communicating and visualizing it to customers is as important. Re-thinking value propositions that are often short-term and tangible must be turned around to communicate the long-term value of services to the customers. (Kindström, 2011) Additionally, the higher customer expectations are the easier they feel dissatisfied with the service: thus, companies should adjust the marketing accordingly to be able to deliver what was promised (Gummesson, 1995). Companies that take these steps also engage in a closer dialogue with the customers as the customers are often keen on communicating and giving feedback through the service outlets. In a service context, the transactional nature of it inevitably increases interactions with customers as well as provides deeper insight into their operations. (Kindström, 2011)

2.2.3 Value co-creation

As supply chains and companies become more global and interconnected, so has the service research started to move beyond dyadic interactions to value network and ecosystem thinking, for complex interactions and business environments require a more realistic approach to capture the true nature of the service business. On top of that, analysis and planning beforehand have made way to adaptation and learning from feedback. (Barile et al., 2016) Indeed, Trischler et al. (2017) suggest that "close collaboration with users can result in a variety of novel outcomes that are high in user benefits and are feasible for the underlying firm." Lusch & Vargo (2006, p. 18) argue that customer becomes a resource or a co-producer rather than a target when they are involved in the value chain. Later, they clarify the separation between co-production, which denotes customer involvement in the process, from co-creation of value, where the customer is always present, as there is no way for a company to create value unilaterally (Vargo & Lusch, 2016). Grönroos & Voima (2013) argue that value can be also perceived as value-in-use, where the focus is no longer on the transactional nature of the products or services but rather emphasizes the ongoing process where customer use of those products and services enables creation of value (Grönroos & Voima, 2013)

Based on a literature review, Dong & Sivakumar (2017) identify three different modes of customer participation, classifying activities on two axes, who and what, which define whether an activity is critical for a service transaction to occur and who can carry out the said activity. Mandatory inputs are carried out by a customer, either requiring tangible or

intangible input. Replaceable activities can be done by either a customer or the company but are as critical for a service transaction to occur. For example, a self-service or automated situation would classify as a replaceable activity. Focusing on replaceable activities can increase the efficiency and productivity of a service. Grönroos & Voima (2013) define this as a direct interaction with service provider's resources that a customer may create value by interacting with. Finally, voluntary actions include service enhancing but not critical activities that benefit either the customer or the company, such as participating in questionnaires about service quality. The framework is presented in figure 1.

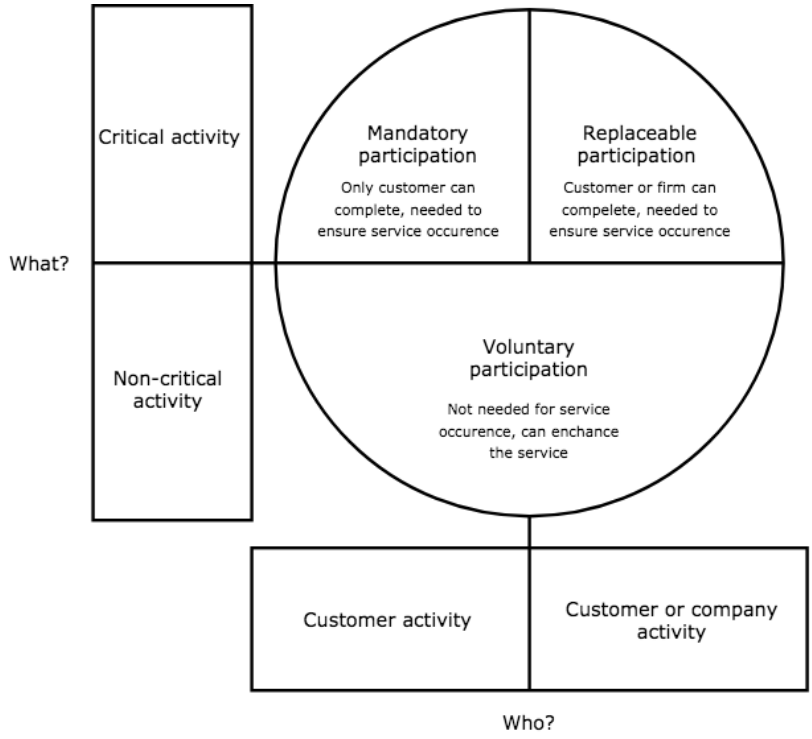

Figure 1. *Customer participation modes (Dong & Sivakumar, 2017)*

Saarijärvi (2012) notes that the mechanisms of value creation have taken a predominant role in the interplay between companies and their customers, where traditional roles readjust for the benefit of increased value creation. Grönroos & Voima (2013) argue that these value spheres are dynamic by nature, where at different stages the provider may invite the customer to join and co-create value.

However, few studies describe the strategic implications of these mechanisms, as not all customers and companies are willing to engage in such relationship. The possibilities outside the traditional exchange model, where only goods and services are exchanged for customers' money, are numerous. As the role of the customer is redefined from being a provider of money to an active counterpart, providing insight, creativity and assistance in production and design processes. (Saarijärvi, 2012) According to Barile et al. (2016) these

co-creation processes not only co-operation but also “well-structured competition to explore, motivate, and reward the best dynamic configuration of resources”.

Chesbrough (2007a) argues that companies should lean towards open business models. In his opinion, most of the innovations made in a company remain unused because there are either no means to use them or no insight into the matter in hand. Instead they should put into use and licenced or pursued in co-operation with third parties. This allows for leveraging external resources and lowering R&D investments. On the other hand, licencing technologies from others has the same effects, as internal resources can be better utilized in combining them with the resources and capabilities of others. Additionally, new markets can be explored, and own capabilities developed even in areas not directly linked to the main market segments. (Chesbrough, 2007a)

Also Aarikka-Stenroos & Jaakkola (2012) add that the customer can take various roles throughout the knowledge intensive service creation process, where the producer has a supportive and advisory role when solving challenges in co-operation with the customer. In different phases of the collaborative process towards a new solution creating more value in use, customers can offer their resources and capabilities for the producer to use, increasing supplier understanding of the need and context by providing their expertise. Reacting to customer needs and providing solutions requires versatile resources and active participation from both parties, as a mutual perspective of the value gained is critical and affects future collaboration. (Aarikka-Stenroos & Jaakkola, 2012) Their proposed process of joint problem-solving framework in for knowledge intensive services is presented in figure 2, with each step involving co-creative activities in various contexts.

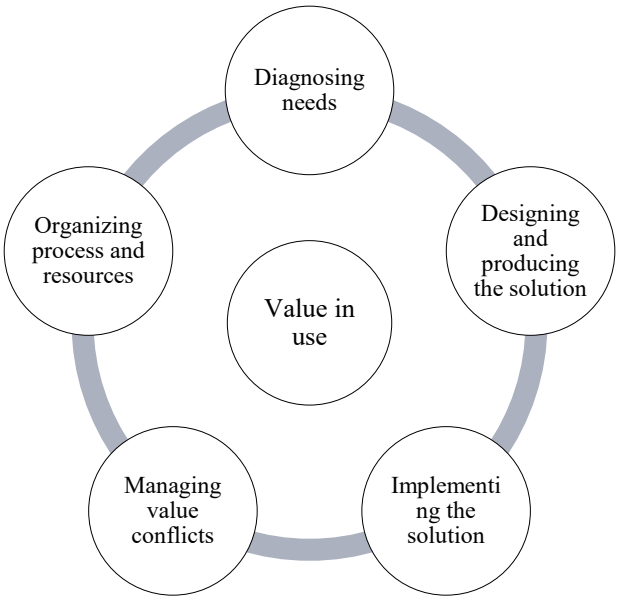

Figure 2. *Joint problem solving as value co-creation (Aarikka-Stenroos & Jaakkola, 2012)*

Grönroos & Voima (2013) describe these modes as value spheres, where provider and customer roles change according to the situation. In the provider sphere, potential value is created by the provider, which later can be turned into real value or value-in-use. Rather than creating value, the provider is a facilitator creating an environment for the value to emerge. In the following joint sphere, customer engagement defines the value creation mode. Depending on the provider interests, customers can also join to co-produce, co-design or co-develop value, which broadens effectively the joint value creation interaction platform. It must be noted, that value is not necessarily created, but the process can be also destructive. For instance, when customer is not contacted at a right time, it might affect the situation negatively. In the customer sphere, the customer combines their re-sources to facilitate value creation in their context. This interplay is visualized in figure 3.

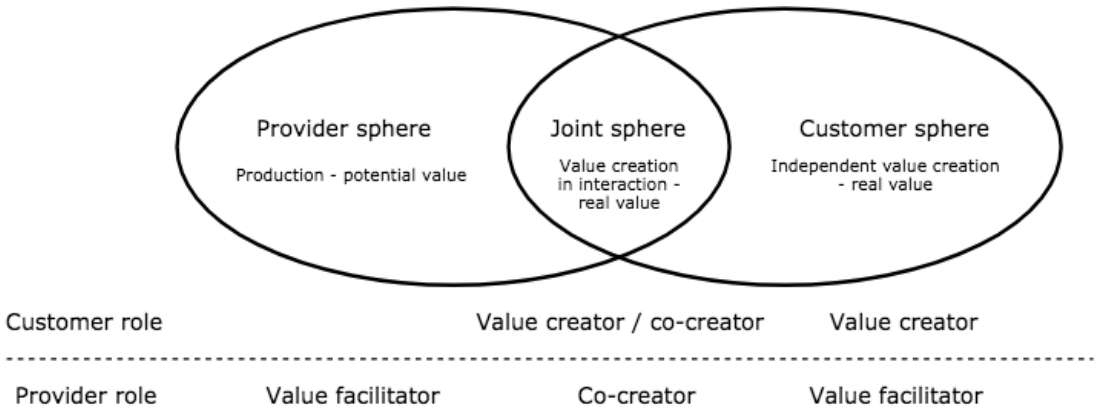

Figure 3. *Value creation spheres (Grönroos & Voima, 2013)*

As mentioned, co-creation processes to not necessarily add value, but can be also destructive by nature. When Trischler et al. (2017) explored the different motivations of user participation and found that the recruitment process should consider those motivations along with team dynamics during the design process, all of which affect the outcome of a development process. As such, the development team members might well not know each other, with each member having their own interests. Thus, the collaboration needs effective facilitation to be effective. Additionally, some personalities might become too dominant within the group and steer the development process to address their specific needs, which might be very specific and not lucrative enough for a wider audience (Trischler et al., 2017)

In digital service business context, interaction in value creation is facilitated via digital service platforms that enable the co-operative modes between a company and its customers. Digital capabilities and platforms help reshape the value chain and discover more value in existing processes as well due to their dynamic and interactive nature. These capabilities are enabled by various technological advancements that enabled high-resolution data collection and analysis both for the company and its customers. In the next chapter, those enablers are identified in the relevant context.

2.3 Enablers of data-based business opportunities

2.3.1 Digital capabilities

Fleisch et al. (2017) investigated the role of the internet in business models and drew a conclusion that until now, every wave of technology has led to new business models being born. Additionally, they state that these disruptions have been the greatest ever been in digital industries. According to their research, the era of division in digital and physical products has come to an end with the internet of things, as products are both physical and digital simultaneously. Their views are confirmed by e.g. Monostori et al. (2016) and Arnold et al. (2016). Following this logic, Bauer et al. (2014) forecast that the new value creation potential is achieved through a combination of new innovative products, new services and business models as well as improved efficiency in production.

Discussing digital services and the shift from goods towards services, the company must also decide whether to keep technologies and other capabilities in-house or to outsource them. Focusing on in-house development can yield good results in the long run, as the software is better suited for the needs and the company retains access to the chosen technologies and key persons. (Porter & Heppelmann, 2014) As noted by Chesbrough (2007a), these activities may well be shared with other companies in form of joint ventures or spin-offs in order to lower the required R&D effort. Arnold et al. (2016) show that the industrial Internet of things is one of the strongest influences on the value proposition in a company’s business model, an exception of which is the automotive industry

in a study across five industries. Additionally, from the business model point of view, Porter & Heppemann (2014) observe an interesting shift from throwaway, cheap to produce -products to durable, long lasting ones.

Monostori et al. (2016) identify further changes to the organization, where digitalization affects all areas in the supply chain of the company, as individual business functions become a mesh of automated, self-organized ones. However, Porter & Heppelmann, (2014) note that gathering the needed skills and manpower in time is a huge effort and might lead to unnecessary proprietary solutions and in time, the competitive advantage gained may be lost.

With the advent of Internet of things, online-enabled devices create increasingly more value in form of services. Manufacturers have never had such access to product and customer data, with which they have got the ability to anticipate and reduce failures and serve their customers better. A manufacturer can capture a larger share of the value chain by retaining ownership for the product and selling it as a service, with customers paying a fee for use of the product, is now possible with a greater amount of fine tuning. The value of this relationship is paid in full to the manufacturer, as e.g. value generated from decreasing a machine's energy consumption is captured by the manufacturer. (Porter & Heppelmann, 2014) In Germany, for example, Bauer et al. (2014) estimate that the additional value captured through increased efficiency is between 15 to 30% depending on the industry, making a direct comparison between 2013 and 2025.

2.3.2 Data collection and big data

What turns a traditional object to a smart one, that effectively enables data collecting, processing and new value creation? The physical part of a solution provides a local and physical use for a connected device, with which the user interacts with. Through sensors, the physical device can measure and record local conditions and receive upstream data from digital sources, such as the internet. The fourth level, analytics, collects and processes the data provided by the devices and enables automations by bi-directional connectivity from internet to the device. None of the different levels would function separately and all of them are needed simultaneously to enable the connection of digital and physical. (Fleisch et al., 2014) The levels of digital connectivity are visualized in figure 4.

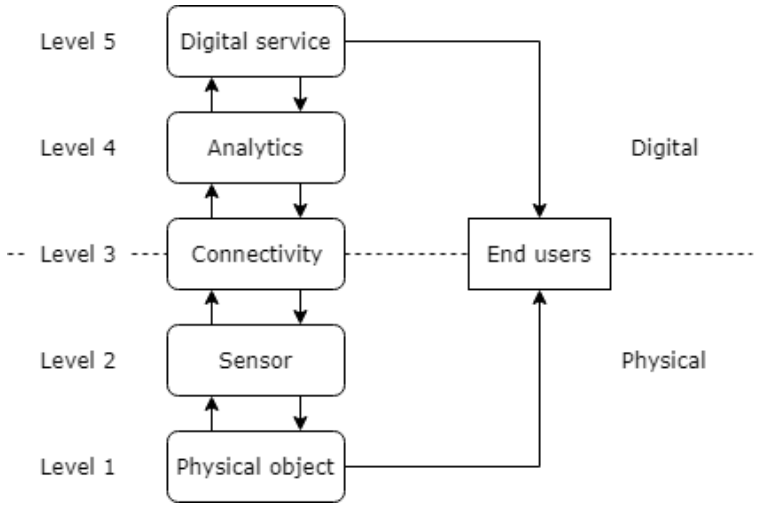

Figure 4. *Levels of digital connectivity (Fleisch et al., 2014)*

McAfee and Brynjolfsson (2012) distinguish three parameters that set big data apart from traditional data analytics. First of them is the sheer volume of data that is created with e.g. each customer transaction. For instance, the authors claim that Walmart collects more than 2.5 petabytes of data every hour in that domain only. Second, there is velocity with which the data is created and analyzed. Instead of waiting for the end result, a network of sensors can provide real-time data to analyze a phenomenon while it is still ongoing.

Finally, there is variety of data that can be collected through different mediums and devices, such as smartphones and the internet. Often that data is unstructured and not useful per se but combining and analyzing different streams of data together makes big data powerful. Wolfert et al. (2017) add that the processing of big data is dependent "on the process-mediated data and metadata to create context and consistency". On top of that, the cost of data processing and computing power is on the decline, making data intensive applications economically feasible. (McAfee & Brynjolfsson, 2012)

Additional reason of sudden rise of the digital is the convergence of digital and physical world. Starting from the first industrial revolution in the 1960's when computers started to transform business ending to cloud computing, the figure below presents how digital has blurred the line between physical world and virtual data in the industrial setting. Starting from the first computerized industrial planning systems, the figure shows the interplay between physical and virtual systems and how they have converged through the years. In today's world, it has become increasingly harder to draw the line where physical ends and virtual starts and vice versa. (Monostori et al., 2016) Different inputs are presented in figure 5.

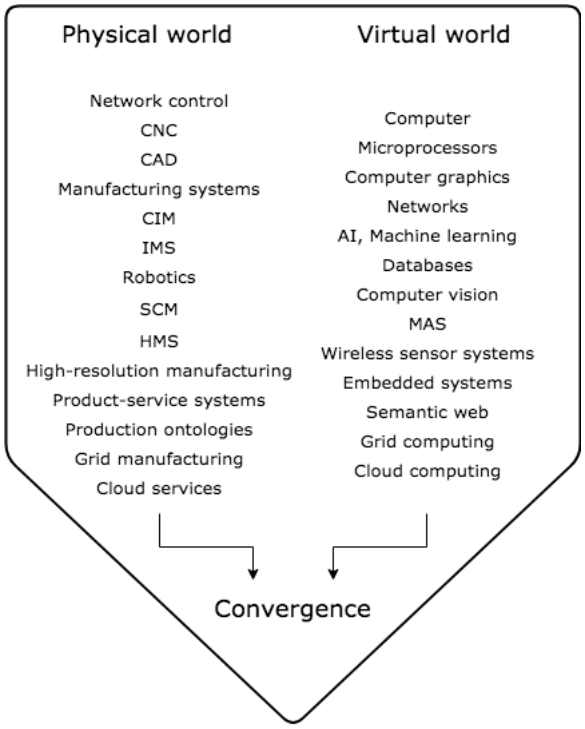

Figure 5. *Convergence of digital and physical inputs (Monostori et al., 2016)*

2.3.3 Digital production systems

Fleisch et al. (2014) argue that as the amount and resolution of data increases, new options for managing things in the physical world increase correspondingly. When the additional cost of making things "smart" is relatively low and a company can only manage what it can measure, the internet-enabled things brings the management possibilities on a new level. Monostori et al. (2016) uses the notion of cyber-physical production system (CPSS) to describe this phenomenon, in which autonomous subsystems are connected throughout value chain, from machine floor to logistics networks. They sum three main characteristics of a CPSS, which are presented with their explanations in table 4 below.

Table 4. *Elements of a CPSS (Monostori et al., 2016)*

Dimension	Explanation
Intelligence (smartness)	Elements of the system can acquire information of their surroundings and act autonomously
Connectedness	Ability to set up and use connections with other elements of the system – including humans – for cooperation and collaboration, and to the knowledge and services available on the internet
Responsiveness	Adjusting and reacting to emerging consumer trends

These systems are based primarily on embedded systems, "intelligent" objects and cyber-physical systems, which enable connectivity for previously passive devices to become sensing and "smart" objects. Examples of such systems already in use in RFID-based logistics solutions, in which every object's current location and status can be wirelessly transmitted and acted on. (Bauer et al., 2014) Bringing this principle further and enabling machine-to-machine communication, where machines and objects interact with each other through IoT-platforms in real time and do not necessarily require human interaction at all (Monostori et al., 2016, Bauer et al., 2014).

As there is more data, the more it can be leveraged to create new business opportunities, automate mundane tasks and to tune operating efficiency. Information generation itself does not create much value, but it reflects the need for the first step in need for real-time data. Processing that information denotes all the required tools to aggregate, refine and use the data. Information linking brings that one step further in bringing that data to a collaborative level and finally as the last step, an autonomous unity of interacting systems is created. The following figure 6 visualizes this outline of the cyber-physical product or manufacturing development process, with each step leading towards a more mature system with benefits of each step listed on the right. (Monostori et al., 2016)

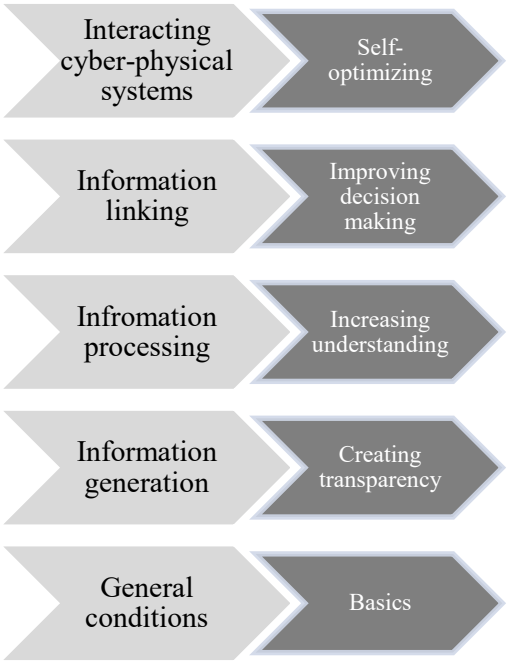

Figure 6. *Cyber-physical system maturity levels (Monostori et al., 2016)*

2.3.4 Customer data collection and reverse use

Crié & Micheaux (2006) argue that in theory, the increased amount of customer data and knowledge collected should produce measurable business results. In practice, many companies struggle to turn the product-centric business models into a customer centric one, where data is actively used to serve customer needs. Several factors contribute to this misalignment, such as problems in data collection, quality control and knowledge management. Notwithstanding further contributing factors like lack of skilled employees with expertise both in hardware and software required to create the right environment and lacking managerial support, many companies fail to properly establish data-based business improvements further than on thought level. (Crié & Micheaux, 2006)

However, when employed properly, the use of data-driven decision-making tools is clearly a source of competitive advantage. In a cross-industry analysis, companies using those tools were 5% more productive and 6% more profitable even after considering other external factors, such as cost of capital and purchased services. Those companies had also higher stock market valuations than their competitors. (McAfee & Brynjolfsson, 2012)

Saarijärvi et. al (2014) studied how using customer data affects the company's business model by illustrating the reverse use of data with three case studies. As their first conclusion they found that reverse use of customer data contributing to customers' value creation provides companies a one-of-a-kind tool to further develop their service orientation, shaping the business logic towards a service oriented one (see Vargo & Lusch, 2008).

Secondly, the contributions to customers' value creation processes allows for repositioning in the market, possibly leading to potential customers choosing the company over a competitor instead. An example of this provided by Saarijärvi et al. (2014) is the Finnish energy company Fortum, whose service enables its customers to track their energy consumption in real time, helping them to become more conscious consumers by adjusting use of electricity. Notably, they write that "as a phenomenon and competitive tool, reverse use of customer data remains in its infancy." Something that many companies should be on the lookout for is serving their own customers better by utilizing the modern tools of data analysis and creation. (Saarijärvi et al., 2014)

Third, engaging customers with new services creates more data and enables the creation of novel service offerings for the benefit of the customers as well as the company alike. Additionally, customer knowledge is an asset, for which other companies might be willing to pay for. (Saarijärvi et al., 2014)

Saarijärvi et al. (2014) note that turning this data into supporting customers' activities, turning the company from a passive facilitator into an active supporter of customers' value creation processes. To do this, the companies need to have an in-depth understanding of the resources that are relevant to customers' value creation and that can support their processes (Saarijärvi et el., 2014). The same view is suggested by Grönroos & Voima (2013), who define a joint sphere of value creation, where a producer might partake in customer's value creation activities. As value is co-created, new understanding and data of customers' activities emerges and is traditionally used to enhance internal processes. On the other hand, the customer data can be used for the benefit of the customer it was collected from, creating novel possibilities to capture more value. (Saarijärvi et al., 2014) The process of reverse use of customer data is illustrated in figure 7.

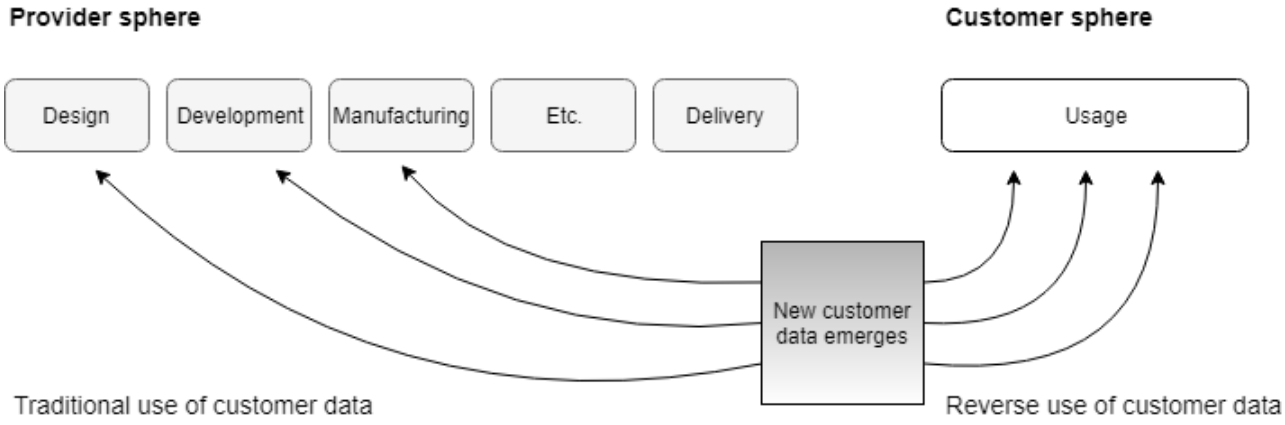

Figure 7. *Reverse use of customer data (Saarijärvi et al. 2014)*

Although Saarijärvi et al. (2014) study reverse use of customer data in the business-to-consumer context, the theme and its concepts stay relevant in an industrial setting as well.

In this context, the concept and reverse use of data research is scarce. In order to better understand collection and use of customer data from an agricultural company point of view, appropriate technology and service concepts have to be examined more in detail.

2.4 Data based value creation in context of smart farming

2.4.1 Definition

Wolfert et al. (2014) define smart agriculture as a location aware system, which bases its decisions on data enhanced by context and situational awareness which are triggered by events in real time. That sets it apart from precision agriculture, which merely enables a greater precision by taking in-field variables into account. Same way, Bimonte et al. (2016) define smart farming simply as the integration of sensor networks into farms to better manage farm activities. For a reason Linna et al. (2017) offer the fact that mechanical improvements increasing harvest yields have been exhausted and thus the focus is shifting to data instead.

As sensor technology advances and equipment is upgraded, an increasing number of farms are enabled to use sophisticated data-driven methods to better monitor their crops and livestock. Smart devices become an extension of conventional tools and methods, requiring less human involvement and controlling processes autonomously. The role of humans in analysis and planning is emphasized, but most of the operational work will be left for machines to tend to. In this context, big data plays a very important role in collecting and analyzing data from both internal and external data sources. With both technologies and approaches changing rapidly, the use of big data will have a large socio-economic impact on farm management and the agriculture industry. (Wolfert et al., 2017)

Although agriculture is one of the most common forms of business, the research in this domain is relatively scarce. Precision agriculture has become a management concept generating various new domains in agriculture related research. (Nikkilä et al., 2010) On the other hand, the technology solutions are not widespread enough to enable adoption of new methods of cultivating crops: Linna et al. (2017) note that in the Finnish Satakunta region, there are less than ten harvest sensors on a total of 3500 working farms. There are few commercial tools that employ the frameworks presented by researchers and existing farm management information systems are still far from being useful for the majority of farmers. Existing software solutions are mostly on-site, and web applications are rare compared to traditional software. (Nikkilä et al., 2010)

2.4.2 Technology factors and data collection

In the past, advisory services were based on knowledge acquired in research experiments. However, there still exists a need to gain insight into precise local conditions, such as

weather-related data. (Wolfert et al., 2017) An issue with the existing solutions is that they are tailored for industrial scale monoculture farms and do not necessarily provide any usefulness for non-industrial farms, which make the majority of farmers. However, that does not imply that data-driven technologies would not be useful, but that there is simply a chasm between the big agribusinesses and the farmers. (Carbonell, 2016)

As farmers are not data processing and management experts, the data should be collected and supplied by a trusted organization that can process and analyze data, enabling farmers to act on that data. The data operator could open that data, where appropriate, combining datasets from multiple producers and aggregating it. The expert company acts as an intermediary partner between the farmers and other users of that data. (Linna et al., 2017) The data flow is visualized in figure 8.

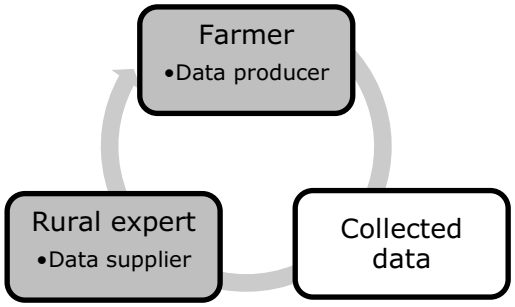

Figure 8. *Data flow (Linna et al., 2017)*

For the farmer, the management cycle represents a cyber-physical system, as smart devices extend conventional tools by adding context aware functions which can be triggered remotely. Human interactions are assisted by machine analyses relying on sensor data and combining that data with external data sources, also capable to make decisions autonomously. Wolfert et al. (2017) identify two possible scenarios, the first one being a closed proprietary system where farmers are tightly integrated into the supply chain and the other, where open and collaborative systems facilitate flexible collaboration between various stakeholders in the food production value chain. Additionally, based on their literature review, they identify numerous technology pull and push factors affecting smart farming development and adoption. These factors are presented in table 5 below.

Table 5. *Smart farming push and pull factors (adopted from Wolfert et al. 2017)*

Push factors	Pull factors
General technology development - Internet of Things and data-driven technologies - Precision Agriculture - Rise of ag-tech companies	**Business drivers** - Increasing efficiency - Improved management control and decision-making - Local-specific management support - Legislation and paper work needs - Increasing volatility in weather conditions
Sophisticated technology - GPS systems - Satellite imaging - Advanced (remote) sensing - Robots - Unmanned Aerial Vehicles (UAVs)	**Public drivers** - Food and nutrition security - Food safety - Sustainability
Data generation and storage - Process-, machine- and human-generated - Interpretation of unstructured data - Advanced data analytics	**General need for more and better information**
Digital connectivity - Increased availability to agriculture practitioners - Computational power increase	
Innovation possibilities - Open farm management systems - Remote/computer-aided advice and decisions - Regionally pooled data for scientific research and advise - On-line farmer shops	

2.4.3 Privacy and governance issues

Although farmers get the expert knowledge to help them better manage their business, research warns of a situation where the data producers are stripped of their rights to control the data created by them. Carbonell (2016) present Monsanto, an American agribusiness, as an example of a company which has been aggressively pushing data-driven technologies onto market. They are being very protective of the data they collect and use

coercive tactics to keep their customers, yet not revealing any of the back-end processes as in how the data is stored, used or distributed. For instance, the company could use its knowledge of current season to speculate on the raw material future markets, creating a huge asymmetry of power. (Carbonell, 2016) Also Linna et al. (2017) note that it is essential to let the farmers have the rights to the data after they have given it to a data operator and that there is a need to clarify personal data use in agricultural context. Hence Wolfert et al. (2017) propose that the future research in this domain should concern governance issues and suitable business models for data sharing in different value chain scenarios.

In this context, giving away the most intricate details of one's business in this level of detail and becoming locked-in cannot be acceptable and will probably result in legislation changes as well as the rise of more open systems. However, according to research, the use of big data is not inherently a negative trend but can also have tremendously positive effects if employed right. (Carbonell, 2016, Wolfert et al. 2017)

2.4.4 Open data in agriculture context

Linna et al. (2017) present an illustration of the value chain and related activities that drive the value network. Here, the expert organization aggregates and analyzes the data and not only provides it back to the farmers, but also following ecosystem thinking selects open data points and enables other actors to co-create value. According to the researchers, opening the data has many benefits, such as traceability of the origin of the produce or an assessment of the field and soil conditions, which affect the rental and sales prices of the fields. Farmers can get a wider variety of analyses from various providers which reduces reliance on any particular service provider. New products may emerge, that take advantage of open datasets provided. The framework is illustrated in figure 9.

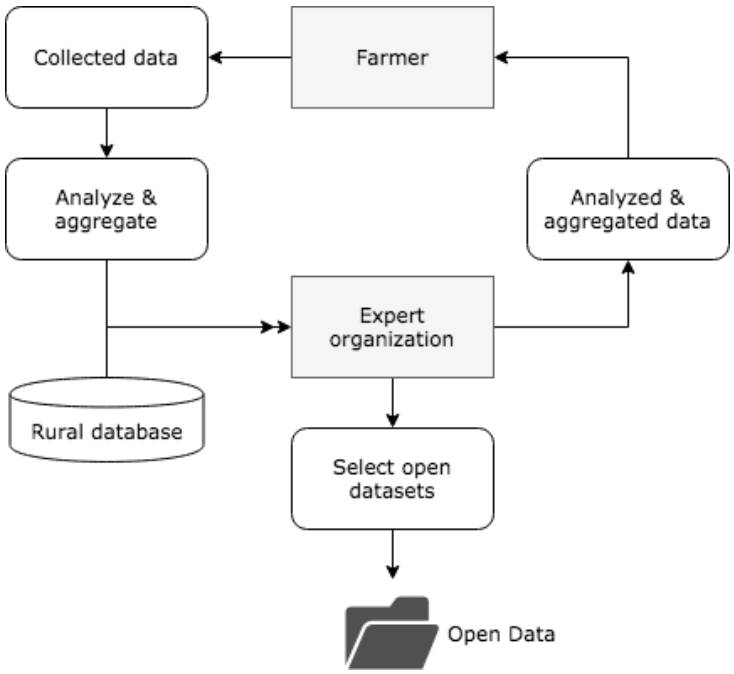

Figure 9. *Expanding data collection framework (Linna et al., 2017)*

To accurately gather and use data, two separate layers of business and technology need to be considered. Together, they enable data-driven decision making and business intelligence, creating a data value chain providing value throughout the process. Furthermore, the stakeholders of the value chain need to consider relevant issues raised by the interdependent business models and governance. The issues of the data value chain are two-fold: at initial stages, challenges are related to use of certain technologies and ensuring system interoperability, at later stages, however, business process governance issues become more challenging as agreements are needed to clarify responsibilities and liabilities of each party. (Wolfert et al., 2017)

2.4.5 Marketing applications

Consumers have shown increasing interest towards sustainable products. However, Grunert et al. (2014) show that European consumers' sustainability concerns and behavior do not necessarily align with the use of sustainability labels on food products. Additionally, there is a lot of variance in many of the countries.

In some countries, food safety scandals and fraudulent products put pressure on the food quality. Li et al. (2018) show that. consumers' purchase intention declines rapidly in the short term after a food safety scandal. Although the decline in purchase intention is largely depending on individual traits and subjective norms, additional parameters that affect intention are government regulation, corporate crisis management, and media coverage of

the events. For a counter-measure, Wang et al. (2015) claim that supply chain co-operation for quality and food safety leads effectively to higher profits for the parties involved. Additionally, they note that consumers are willing to pay the price premium for increased and companies investing to quality are facing increasing demand when that quality is communicated right to consumers.

As global food producers introduced trademarks and patents to globalize their brands, those same mechanisms work for the traceability and geographical indicators that the food consumed is indeed from the sources it is claimed to be from. However, because of the complexity of the supply chain, that cannot be achieved by voluntary labeling but requires co-operation throughout the supply chain to ensure credibility and trust from their origin to consumers. (Giovannucci et al., 2010) The same phenomenon is observed by Linna et al. (2017) who also list traceable goods as an important benefit of data-oriented agriculture.

For many of the producers, however, it remains difficult to co-operate with large retailers, as they cannot comply with all the requirements of those retailers. Unless the small producers are involved in an organized supply network, they cannot effectively compete with the larger brands. Additionally, the largest cost drivers for food are indeed the supply chain and marketing expenditures. Governing the supply chain and providing reasonable means to govern intellectual property in those supply chains are required to create a functional market for small, local retailer products. (Giovannucci et al., 2010)

2.5 Synthesis

Relevant themes for this thesis combine elements from previous studies. The service transformation literature provides a starting point for the current situation in the case company, which is in the beginning of that process. Combined with value co-creation literature examples and business model aspects, the case company aims to find a suitable strategic combination of the two in their industry. To successfully co-create value requires expanding of the joint value creation processes, where potential value is only created by the provider and later turned into real value or value-in-use by the customer. Expanding on that premise, the digital capability literature presents answers for capturing more data and effectively turning that into value for both providers and customers.

Finally, the agriculture industry specific studies clarify the current governance issues and future challenges regarding data-based service operations. The research in this domain is not yet mature due to lack of real world case examples, for not many service networks in this context have been studied. However, the change is prevalent, as Linna et al. (2017) and Wolfert et al. (2017) list many drivers that turn the focus from physical conditions to digital monitoring and automation instead. Furthermore, controlling the supply chain and marketing benefits for own and customers' products are key action points for the case company.

3. RESEARCH METHOD

3.1 Research strategy and methods

The research was conducted using a case study strategy to gather insight into the ways a company could leverage the customer data in new business creation. The case company was selected on a convenience basis, as they had shown interest in developing their service businesses further especially in the digital domain.

The research was chosen to be an exploratory one since its aim is to provide new insight into the subject. Saunders et al. (2011, p. 140) name three principal ways of conducting exploratory research as "a search of the literature, interviewing 'experts' in the subject and conducting focus group interviews." This research will be focusing on the first two themes.

The strategy employed was a case study, as the aim was to form a synthesis based on the findings in the interviewed business units. This strategy was chosen because of its applicability in the situation, in which the 'why' and 'how' questions are the most important ones to answer as proposed by Saunders et al. (2011).

3.2 Case company

The case company, *CompanyA*, operates in a traditional product-based industry, agriculture, and has multiple business units. These units are very independent and have digitalization efforts of their own but have a shared need regarding new business and value creation for their customers, also as a means of differentiation from their closest competitors. The incumbents of the market are established, and new entrants are rare.

CompanyA has been consolidating a some of unprofitable business units and are focusing on profitable service creation with the remaining products instead. This has resulted in a lower turnover in comparison to historical numbers, but in a more profitable operating environment. However, there is a need for a balance between the two, as it is not possible to outsource all physical goods.

Currently, a lot of customer data *CompanyA* has collected remains unused and thus not profiting the company, in which they would like to see to change. By either using it more efficiently internally or creating means to have customers benefit more from that body of knowledge, cost savings and new revenue methods are sought. Expanding the service offering and providing novel solutions is hoped to bring growth in traditional and new markets alike, into which the company would like to expand.

3.3 Data collection

Primary data was collected using semi-structured interviews, that were held during March and April 2018. Respondents were interviewed privately with additional questions sent later via e-mail. The interviews were audio recorded for them to be easily available afterwards. The interviewees were generally employed in managerial and expert positions. Each respondent was interviewed individually. The interview sample was selected on convenience basis to cover all functions companywide to gain an overview of the situation. On top of the interviews, personal observations of the internal processes and functions were made through project work for *CompanyA*.

Preliminary interview questions were first listed and improved upon to form a structure for the interview. The final themes were background questions, industry details, use of customer data, customer needs, operating environment and internal operating methods. On top of that, additional questions were asked that concerned the position of the interviewee. The interview template is presented in Appendix 1.

On most of the themes, all interviewees were treated equally and asked to consider the situation with only their business unit in mind. Additional questions were then asked to assess the implications for the whole company. In half of the interviews, an expert from Gofore Oyj was present to ask additional questions around the topic. All the interviewees were employed by *CompanyA* at the time of the interviews. Interviewees and their roles are presented in table 6 below.

Table 6. *Interviewees and their roles*

Interviewee	Role
P1	Head of Business Unit 1
P2	Head of Business Unit 2
P3	Chief Quality Officer
P4	CEO
P5	Research Director
P6	Development Manager
P7	Senior Sales Representative

For top-level management, the focus was kept on the overall company level and strategic implications. With the experts, more focused additional questions were used in order to

understand the underlying processes better, with their inputs and outputs and relationships with other activities within the company.

3.4 Data analysis

Afterwards, the interview recordings and notes were analyzed and prepared to be presented. After that, the data was sent back to the company for re-evaluation and correction of possible mistakes. Audio recordings were listened through and additional notes were added to the ones made during the interview. During the data analysis, additional themes that interviewees brought up frequently were observed and added to the structure of the next chapter, which is otherwise based on the themes presented in the interview template. For each theme, prevalent issues were collected into tabular form and clarified. As the results were translated from Finnish to English, some slight differences might occur in the wordings.

In the analysis phase, any additional questions or possible elaborations were asked via email. The analysis was conducted from the digital service offering point of view and thus does not consider other strategic options outside of that domain. Finally, the results of the research were synthesized and separated according to the interview themes.

4. RESULTS

This chapter presents the interview results and separates them by themes determined in the interview template (see Appendix A). At the end of each chapter, the key findings are gathered into a table.

A few years ago, the company chose to seek new opportunities in data-based value creation and to shift its focus from goods towards services. Additionally, the management saw that there is a clear market need for more refined solutions, as the current ones do not provide e.g. a clear insight into customers' operations and an ability to help them in their daily operations. Increased customer knowledge and data refinement would also make internal operations more efficient. Although quality products are in the heart of the business, a complementing service offering is hoped to attract customers in a novel way no competitor has done before.

That was a starting point for the current day situation, where these new services continue to evolve in their pilot phase. However, there is a lot to do in the field and these solutions are still in their infancy. So far, the feedback has been positive and there exists a clear market and customer need for these solutions, which could generate a lot of additional revenue both in domestic and foreign markets.

4.1 Operating environment

The company has customers in two market sectors. In the domestic market, the other one is a mature one with no significant growth in volume in sight. Only few competitors remain, and the competition is challenging. Albeit the market is stagnant, it is not a declining one either, but offering a steady level of income. One of the managers noted that as far as he could remember, the competition has been tough and is based mostly on price. Although service quality matters, it is currently not a main driver for customer conversion for any of the companies in the industry, rather than a tool to increase customer satisfaction and thus retention rates as well.

The second market has growth potential with globally rising producer prices and market growth. As this business unit is active in international markets, there is potential to gain a larger foothold in the growing global markets as well. In the domestic market, the business unit does not have many competitors. However, on global scale the business unit is among the smallest of its kind. Hence, the business unit cannot compete with price as it does not have the economies of scale on its side, so other means of differentiation is a must. In both sectors, none of their competitors have yet been showing interest in the service business, which might prove to be an excellent advantage.

Globally, the market is growing at a steady pace as products become more and more specialized, and many smaller competitors have been bought by their bigger rivals. However, there remains room for local companies as well as the industry requires a high expertise in the local conditions. The business units are compared in the table number 7 below.

Table 7. *Business unit cross-comparison*

	BU 1	**BU 2**
Target market	Domestic	Domestic, international
Market growth	Steady, slightly declining	Domestic: mature, slight growth International: a lot of growth potential
Competition	Few key manufacturers	Domestic: few key manufacturers Global: large, dominant manufacturers

The company operates mainly inside Finnish borders but has some international operations. These markets could offer significant growth possibilities especially in the form of services, as the transportation of goods is expensive and competing against the local producers with price is not an option.

Although both industries are mature, have established markets and established competitors, it does not mean that the business has been stale. Customers' processes and needs have changed a lot throughout the years and will change perpetually, as technological advancements and latest research pave way for new operating methods. One of the interviewees noted, that although the industry is a traditional one, the only thing that has been certain has been change.

On the other hand, the market is in the middle of a fast transformation process as the customer base is rapidly changing in the wake of consolidations. Because of tough competition, the industry is facing a goods-to-services transformation, as just the right price is not enough to retain existing customers. In this regard, the interviewees feel that the company is ahead of its competition, as none of the competitors locally or internationally have been presenting any such service innovations based on digital technologies and seem content to only produce goods instead.

Hence, the competition in service business comes from other directions, equipment manufacturers and other software solution providers specialized in agriculture. In that way, there is a unique possibility to combine different approaches in a novel way with new mediums of value creation.

4.2 Data privacy and ownership

For business unit 1, most of the customers are eager to try new services, as increased insight into their own processes would lower their costs. As providing these services requires certain technological capabilities from the customer, it is an easy way to gain more value from their investment. However, in a heterogenous customer base, the installed base of production equipment and technological capabilities vary. Additionally, if the current solutions work well enough, there is no incentive for the customers to carry out software updates that could enable more features on the existing equipment. Unfortunately, that also means that outdated software imposes some limits, within which the company must operate.

According to some respondents, a minority of customers have been very protective about giving access to their operating data to a manufacturer, as they fail to see the potential of the service. Instead, they feel that these services are potentially a gimmick to make them buy more, as both business units sell their products directly to the customers. One of the managers noted:

"It's absurd that technology companies like Google know everything what you do, but when we would want to help our customers in their business, they refuse to give access to the data we'd need."

In talks with the pilot project customers, they expressed that they are very happy with the results so far and would be happy to extend these services. However, to win over the naysayers, the benefits and responsibilities must be clearly communicated. The thoughts were similar in business unit 2 as well, maybe with a slightly higher resistance. The solution to that was almost unanimous: when the service products are in such state that the company can clearly demonstrate the business benefits it brings, some of the sceptics will start using it.

Almost all the interviewees noted that useful data is often scattered in many systems, both internal and external. Some of the key data points remain inaccessible, as the organizations who own them are being overly protective. Hence, connecting the different sources requires co-operation from the customer and their time, which they might not have or be willing to spend as requesting that data is mostly a manual process. Many of those processes could be automated and company has had talks with those parties, but the response has been mostly negative. Many of the interviewees noted that some companies refuse even talks about an exchange of data. As another example of protectionism, in talks with a third-party company they refused to exchange data with the focal company, although it would have been a benefit for their customers as well.

One solution to the problem was suggested, in which the customers could select the data sources they would like the company to tap into. The benefits of the system are obvious,

as it would enable both transparency and better service levels for the customer. Additionally, it would make co-operation with other parties easier if there is enough pressure from the customer side to open those data sources. To achieve this, a unified service platform should be created, where the customers could have an overview of their currently active services, their history and a dashboard-like interface, where the customer could give the company the rights to access data sources that stem from different systems. According to the interviewees, selling or exchanging data with third parties should be based on a win-win exchange and on top of that, making it understandable with clearly stated benefits and responsibilities. The key findings in this domain are collected in table 8.

Table 8. *Findings: Collecting data*

Factors hindering progress	Explanation
Data protectionism	Key data points remain inaccessible, companies are overly protective with their data
Privacy concerns	A minority of customers feel that operational data is too intimate to collect
Installed equipment	Certain limits on data collection are imposed by the equipment installed

4.3 Partners

Finding the right partners has proven to be a challenge, as mentioned in the previous chapter. In digital services, the customer has outsourced most of the work involved, as there are not enough internal resources to create a digital service offering. Additionally, it would be riskier to build all the solutions in-house. Some interviewees noted that with the current development efforts they feel lucky enough to have found the right partners that share their vision; the customer comes first.

On top of that, it would be a significant risk to build a development team from nothing in such a short time. Traditionally the company's IT-department has been only business oriented and there has been no software development in-house, apart from some modifications and custom solutions based on e.g. Microsoft Excel. Focusing on the research, service development and operations is currently deemed more important than developing everything in-house. Some interviewees saw that as a strength:

"We are not IT-professionals; in a way, that is a strength since we are more customer than technology oriented."

In the previous chapter it was discussed that some of the other players in the industry are protective of their data. Despite this, some stakeholders must be relied on to provide vital customer data. Third parties providing analyses and measurement technology remain important now and, in the future, there is willingness to deepen that co-operation relationship.

Later, however, there is a willingness to build some of the technology solutions in-house to lessen the dependency on other manufacturers. This would drive the costs and communication overhead down and facilitate the creation of the best possible solutions, which may often not be the case with non-specialized measurement devices. Additionally, when speaking of IoT-enabled devices, insourcing opens more control to the platform and data itself, as often there is a cost involved in the API-usage. On the other hand, considering partnerships with existing equipment providers should not be completely excluded, as there is potential for novel ways of value creation by combining both companies' strengths. The key findings in this theme are collected and elaborated in table 9.

Table 9. *Findings: Partners*

Relevant partnership choice	Explanation
Finding right partners	Resourcing challenge in service creation
Stakeholder relationships	Some third parties are vital to the service business, how to build on them
Insourcing software and hardware	Building technology solutions in-house

4.4 Production processes

In its current form, product quality is measured mostly by skilled employees and a few test suites for product samples from the current batch. Lately, this has been problematic especially in business unit 2, where the product quality parameters are higher. In business unit 1, the allowed deviations from optimal are larger, so there have not been any significant problems involving the quality of the products. Some customers have been accusing the company of delivering bad quality. According to the half of the interviewees, there is a clear need to monitor our own processes more closely. Additionally, that information should be provided to the customer so that quality problems and their causes can be tracked down to the production or logistics.

There is an ongoing process for establishing a better-quality system, which monitors numerous parameters in product quality. Additionally, an IoT-platform procurement is ongoing, which means that there will be more opportunities to monitor quality from raw materials all the way to the product. Those sensors would later cover the whole production

process and analyze the most important variables, e.g. temperature and humidity, in critical phases of production. On the other hand, customers should be able to provide direct feedback traceable down to batch level so that the company could identify possible problems and adjust their production processes quickly.

In business unit 2 for some key customers this kind of a system is in effect, although only in paper form. That makes it impossible to draw conclusions in real time, as the results are sent in with a delay. The delay makes it harder to analyze certain batch or transport conditions that might have affected the quality in a degrading manner. However, the interviewees felt that the system should be expanded to cover all customers to gather data in real time and to increase transparency.

In production, knowing the raw material properties is a vital part of controlling the process. One interviewee noted, that maybe the company is looking for the wrong qualities altogether. Better monitoring should bring better understanding of the raw material qualities that affect the process and what are the mechanisms of the deviations from standard they cause. Controlling variance and different variables in raw materials allows for better understanding of how different variables affect the products and their functionality. In addition, to be able to control the process better means optimal production settings for different raw materials, cutting downtime and adjustments needed for each batch of products. Ultimately, the goal is to have a self-adjusting production system, that can adjust itself on the fly based on the sensory data parameters for better yields and a more controlled process.

Although currently products are tested with analysis tools, there remains the question how these products will work on customers' machines. As there are plenty of brands and different setups, it is hard to tell which factors affect customers' perceived quality of the product. According to the interviewees, it would be beneficial to have some prevalent machinery installed for testing purposes. Not only would assure the functionality, but also give an estimate of the correct settings on that type of machine. Testing products with real world equipment and making that data available is should also reassure the customers that the products work in their machines as expected. The key findings are presented in table 10.

Table 10. *Findings: Production*

Key process enhancement point	Explanation
Quality issues	Tracking quality is troublesome
Production process control	Add and monitor key measurement points for production processes and raw materials
Product testing	Testing suite for real world equipment, customer feedback

4.5 Internal efficiency and logistics

When creating new services, catering for a wider audience requires manpower. Currently, the company has outsourced their digital service creation. However, a lot of effort is needed especially in sales and tending to customers' needs in person, since customer sites are very different by nature. Some interviews stated that one of the greatest digitalization challenges lies within the company: to automate and optimize internal processes so, that they benefit both the employees and the customers.

Currently, many internal processes remain unautomated and require human interaction to complete. A large part of internal processes is done by hand and require numerous tasks in various systems to complete e.g. an order, as filling one requires bouncing back and forth from program to program. Many of the systems are not properly integrated with each other. An additional challenge is the interoperability and level of automation in within the IT-systems themselves, which again is currently problematic and time consuming for the employees. Data analysis tools are lacking and delivering current services and reports for customers requires manual labor, all of which should be automated in the near future, not only to save on cost of labor but also to increase the time in more productive tasks.

Logistics is another big cost driver for the company, as the products need to be delivered to customer sites, which are often scattered far and wide. Improving logistics would mean tremendous cost reductions, since that is one of the most expensive parts in the supply chain. Although the route calculation processes and logistics are widely automated, better knowledge of customer storage levels would enable new ways of optimizing routes and pre-emptive sales. Logistics were named to be a priority by many of the interviewees.

Currently, the IT-infrastructure includes an SAP based ERP-system along with a customer relationship management system, along with smaller operational systems. Products are sold both online and through personal sales contacts. Currently, an IoT-platform is in the procurement process, first and foremost for production purposes as discussed in the

previous chapter. Many other future integrations, also in customer premises, are planned to be utilizing and depending on this platform.

Organized sourcing of IT-systems that are viable down the road is a top priority, claimed one of the interviewees. Many others agreed on that view. For internal efficiency, platforms and operational IT-systems are a critical part. Interviewees noted that there is a lot to gain in renewing and updating the existing systems. For the larger systems, one interviewee noted that there is no room for proprietary solutions in this regard, and that these systems need to be sourced from reliable big companies to allow them to be viable down the road. Proprietary and tailor-made were deemed too expensive and as in the past, the company has had some experiences in buying systems that later proved inadequate, there is no wishes to repeat those mistakes.

However, many of the current internal IT solutions have reach or are starting reach the end of their lives. It was noted that there must always remain a possibility to renew certain parts when needed. At a certain point, the company must remain to be able to decide to scrap some systems that do not serve their needs anymore. Currently there are many critical systems that need a renewal as fast as possible.

As the technologies evolve, there will be many fads and trends to avoid. With the first projects, interviewees admitted that there was oversight regarding what goals to pursue and how money was spent. Now they feel that the service development process is a more controlled and mature one with clear goals in sight.

Looking in the past, one of the interviewees noted, always reveals that we were doing too little and spending on the wrong things, but most importantly, it shows that we did something and have gained something for that investment. He also noted that there is always a danger involved when creating new business models and pushing new technologies onto the market. The priorities need to remain clear as in there needs to be a client need and a reason for the technology push, to avoid some of the mistakes many companies pushing new technologies make.

One of the greatest strengths of the company is the employees, as many of them have been with the company for decades and have a strong expertise in the field. However, to preserve that advantage, the knowledge needs to be preserved and transferred forward. Having systems in place that enable knowledge transfer and guide the users to the right track is one key part in successfully providing new employees the tools to serve the customers. The key findings regarding this theme are collected in table 11.

Table 11. *Findings: internal efficiency and logistics*

Digital system improvement	Explanation
Process automation	Many of the processes require manual tasks to complete
IT-integration	Systems do not fit together and communicate well enough
Outdated systems	Some systems are outdated and require urgent replacements
Logistics optimization	Customer data is not used enough to predict logistics needs

4.6 Marketing opportunities

One theme that kept coming up during the interviews was the potential marketing value that the data could give. Consumers value e.g. environmentally friendly products more and more. By utilizing the data collected, new marketing opportunities emerge for various product classes.

In the modern world, it is more important than ever to claim the authenticity and origin of products. This can be only achieved by recording the data from the very beginning of the supply chain all the way to the end-customer. Accurately knowing the amount of feed used, environmental conditions and produced amounts gives means to calculate the costs, effects on the environment and animal well-being in an unprecedented manner. The company could demonstrate the environmental friendliness of their products, as better monitoring would greatly increase the customers' accuracy in using them.

Additionally, expanding that information chain vertically through the supply chain means that the data gathered can be made available for consumers as well. In future, the service platforms could enable traceability throughout the supply chain, which could be a great selling point for the products as well. Expanding downstream, co-branding and co-marketing consumer products labeled by the company brands potentially boosts sales and provide additional brand awareness inside as well as outside the customer base. The key findings in this domain are collected in table 12.

Table 12. *Findings: Marketing*

Marketing activity	Explanation
Consumer marketing	Co-marketing products with producers for consumers
Brand image	Brand image perception can be enhanced by demonstrating environmental friendliness
Capturing supply chain data and value	Expanding vertically to capture more value

4.7 Role of service business

Services do not currently have a business model, apart from the fact that it increases customer satisfaction and retention rates. However, as those parameters are hard to measure and to capture as numbers, there is an ongoing discussion as what kind of a business model to pursue when talking about future service offering. As one of the managers put it:

"For now, our services are not provided for free, but without an extra charge."

The price of the services is carried onto the products, with the latest additions being in a pilot phase. The service offering is seen to increase retention rates, yet that is hard to measure in numbers. In the worst case, a customer may use the services but buy almost matching products from a competitor. However, all the interviewees agreed on the fact that services should be monetized to some extent at some point. In the future, services could comprise of different packages or service levels that customers could choose from. Additionally, services are meant to be sold as larger solutions or the customer could even partly outsource a part of their operations. Exploiting supply chain management possibilities vertically could mean novel ways of value creation. In the future, the company wants to have a more of a solutions provider role, taking a broader set of responsibilities in their customers' operations.

There is also the expert role of the employees, for which better understanding and customer knowledge would be beneficial in form of target customer segment analyses and other big data applications. The more customer knowledge the company has, the better they can employ that knowledge in practice and adjust the product portfolio, for instance.

An interviewee noted that the current product portfolio might even be too large in its current form. In the future, products can be even more tailored to customer specific needs, so there might be room for cutting down on the product range. That might also be the

case, since the customer base is slowly changing towards bigger and bigger businesses with certain needs.

In the business unit 2, the opportunities to digitalize the industry are even more profound. In many ways, that market operates with the old ways and methods; mostly pen and paper. There is a lot of manual labor involved and many capabilities remain untapped. Some competition in this regard exists, however the combination and some features are unique and enable co-operation with various systems. There is a clear market benefit for the service product as it increases the efficiency of using the feeds in a way no other system can. At many customer sites, the gap to bridge is large, as these kinds of digital possibilities are unheard of.

Additionally, the market is a growing one both globally and locally, and new companies enter the industry. However, even the experienced ones with less advanced equipment and production methods struggle to optimize their production and to manage their facilities. With the situation being that in some markets and if those customers can make profit with the margins and efficiency they have now, there is a lot of ground to cover in form of optimization. One of the interviewees summarized the situation:

"If our customers can now make profit with these rates, what if by using our services the customer can boost their efficiency by 40%, and that in the current market situation."

Although new service creation was named an integral part of the future strategy, according to the interviewees goods remain vital for the success of the service offering. Yet it remains to be seen, what kind of a role the services will take in the offering and what is the ratio of products and services of the total business unit turnover. What is certain and agreed upon, however, is that from now on the services are a vital part of the company strategy and operations. Producing goods is an important part as well, but it is not the whole concept anymore. For now, the products and their strong brands have the status quo, but none of the interviewees could not estimate, how big and what kind of a role the service business will have in near or distant future. The key findings in this domain are elaborated in table 13.

Table 13. *Findings: role of the service business*

Service business development	**Explanation**
Service business model does not exist	Services are a complementary part of the product sales
Service provision	*CompanyA* wants to be a solutions provider
Service strategy	Choosing a clear strategy to follow, experimenting with service concepts

4.8 Service development

As the current service offering is relatively limited, a lot of ideas arose in the discussions with the interviewees. There remains a lot of room for improvement, especially in data analysis, mining and opening company data for the benefit of customers.

With their resources and competences, current leading technology companies such as Google could penetrate the market relatively quickly. Until that, it pays off to be among the first to tap into this new market and gain a competitive advantage before other companies get interested. On a positive side, all interviewees agreed on that this is an endeavor no other competitor has even started yet. Additionally, it was seen important that the first steps are made before the big competitors start to gain interest in this field. When larger competitors have similar products, there are less means to compete against them with their vast resources. Some of the leading agriculture companies, such as Monsanto and John Deere (Carbonell, 2016, John Deere, 2018) have started already creating their own digital service offering, augmenting their products with own sensory and environmental data. However, adapting to local conditions and local customer needs requires expertise that the industrial scale agriculture companies do not necessarily have or target with their products.

Additionally, the interviewees want to put the data to better use by utilizing different analysis methods. By using the latest big data analysis and AI technologies, the company could e.g. predict upcoming orders and optimize logistics. On top of that, customers would like to compare their own success against a relative target group or knowledge on best practices could be better shared among the customer base, as it would benefit everyone involved. An interviewee noted, that data analysis would enable new ways of directing support for the customers that need it the most:

"For now, our services benefit mostly the customer that data was collected from. I believe that later we want to analyze the whole data set to better understand causalities in their processes and adjust our support to them accordingly."

Other processes to utilize the data in would be product portfolio optimizations and product marketing and sales support, which would be based on more advanced price-performance ratio calculations made in real world environments. Current tests and calculations for products are conducted in laboratory conditions, which do not cover all environmental factors due to the nature of such tests. By collecting and examining data stemming from different conditions, it would be easier to draw conclusions on e.g. how different products behave with different breeds. Far more advanced and accurate price performance ratio calculations could be made available to the customer through collecting and analyzing that data for them.

Environmental impact is another key factor, where the company would like to both help their customers and use that as a marketing advantage. Through the future service offering, the company is hoping to achieve better reporting options for the farmers but as well provide them with accurate data on e.g. how much feeds they needed in their production and what was the price for that efficiency. Additionally, reporting tools adhering to local reporting standards for less bureaucracy would be helpful for the customers, who now must resort to manual tools in responsibilities stated by law. Automated generation and delivery of those reports would make a farmer's life a lot easier. As customers are enabled to monitor their operating environment better, the focal company could turn that data into better products and customers to produce more with using less resources.

In that regard, the future is most likely bringing additional environmental regulations that require additional consideration. By using the collected data, the company would like to demonstrate how they are dedicated to control the environmental effects caused by agriculture. For customers, less environmental impact means more production capacity. Promising that using the focal company's product has e.g. 15% less environmental impact does not sound like much: but for the customers, it is a different matter that they could increase their production by that same 15%. One of the interviewees noted on the subject as a whole:

"Nowadays justifying things requires scientific proof, without data to show that it's impossible to claim something."

An interesting factor is that consumers have a large impact on the business and on the areas the company is active in. For instance, one interviewee noted, when soy use in animal feeds was a hot topic of public discussion, the company rushed remove the rest of it across the product portfolio and to promote the fact that soy is not used in our feeds. As most of the products did not contain soy, the process was straightforward, but possibly had a positive effect on the brand image.

Considering the previous example, the consumer level interests are one thing to closely follow as they can potentially have an impact on the whole industry. As the company's success is closely related to the success of its customers, it is important to monitor the consumer space trends and to act accordingly. Thinking different service combinations with marketing options has be all-encompassing through the supply chain to consumer level, as their interests align with the company interests. The key findings in this theme are presented in table 14.

Table 14. *Findings: service development*

Service development risks and opportunities	Explanation
Market risk	Large technology companies might overtake the market
Big data collection and analysis	Data analysis tools are lacking
Consumer trend knowledge	Adjusting and reacting to emerging consumer trends

When talking about sharing knowledge, one of the interviewees noted that it has always been an integral part of the business. In a way, it is also the focal company's responsibility to share the knowledge and help the customers in the best way possible, as it is both in their and their customers' interests. On top of that, also consumers care about sustainable agriculture. Partially that role is included in the company strategy, as having a positive impact on the industry also potentially has a positive impact on the sales. However, there exists a need to share that knowledge in better ways and through more channels than the current ones. Although the company's experts consult their customers daily, the times between customer contacts can be lengthy. During that time, it would be helpful to remain in contact through other channels.

4.9 Internationalization options

On the subject of service exports, the interviewees agreed that growth in services should be sought in the international markets as well. Currently there are no international customers in the service business. Some products are exported to markets abroad, and many of those markets have growth potential in both services and products. A challenge is to adapt to local and international competitors' efforts and to differentiate the offering enough to succeed. Interviewees agreed on the fact that importing goods is hard and that in comparison, localizing services is far easier.

Entering new markets requires careful planning, co-operation with the local authorities and import laws and it remains hard to gain foothold in the target markets. With services, localizing is easier and can be done in co-operation with a local supplier. The services should bring positive attention and wake potential customers' interest, which was seen important when entering new markets. After that, goods can follow as licensed ones through the local partner or from own production. An additional possibility would be to seek local partners, with whom the company could provide their service concept in that country, making the risks smaller.

Especially developing countries are important target markets, as the service offerings could be easily adapted to many conditions. In the industrialized countries, some entry barriers exist in form of established service providers and producers with a larger market share. In new target markets, these kinds of services are far less advanced but the means to use them are widespread. Additionally, the company is a forerunner on some of those markets, which might be a competitive advantage in the long run as there are some customers already.

"These solutions are simple enough to take to developing countries; in a way, being a Finnish company over there is an advantage."

Additionally, being a Finnish company brings an advantage at least when considering marketing value because of data protection and privacy discussions. Having a neutral image, the country is often associated with environmental friendliness and values, which may increase trust in the target markets, if branded right.

4.10 Summary of key development areas in CompanyA

This chapter summarizes the findings listed at the end of each interview theme and ranks them by importance in relation to company strategy. Each quality is ranked on either as less important, neutral, important and very important, represented by plus and minus symbols. The importance of each items reflects its importance with current situation, the most important ones requiring urgent attention first. However, some of the less relevant findings now will be very important in a year or two, when the first steps have been taken.

Currently, the most relevant findings are related to own process automation and enhancements that enable the further development of service offering. Many of the current processes require improvements in order to enable consistent and effective data collection and refinement to serve as a foundation for the service creation efforts. The findings market as important with a single plus symbol are less vital momentarily but should be key points to consider when creating a strategy roadmap not only for services but for products as well. All key findings and their assessed importance levels are presented in the table 15.

Table 15. *Summary of key action points for enabling data-based service operations*

Finding	Explanation	Importance
Data protectionism	*Key data points remain inaccessible, companies are overly protective with their data*	+
Privacy concerns	*A minority of customers feel that operational data is too intimate to collect*	+-
Installed equipment	*Certain limits on data collection are imposed by the equipment installed*	+
Finding right partners	*Resourcing challenge in service creation*	-
Stakeholder relationships	*Some third parties are vital to the service business, how to build on them*	++
Insourcing software and hardware	*Building technology solutions in-house*	+-
Quality issues	*Tracking quality is troublesome*	+
Production process control	*Add and monitor key measurement points for production processes and raw materials*	+
Product testing	*Testing suite for real world equipment, customer feedback*	-
Process automation	*Many of the processes require manual tasks to complete*	++
IT-integration	*Systems do not fit together and communicate well enough*	++
Outdated systems	*Some systems are outdated and require urgent replacements*	+
Logistics optimization	*Customer data is not used enough to predict logistics needs*	+
Consumer marketing	*Co-marketing products with producers for consumers*	++
Brand image	*Brand image perception can be enhanced by demonstrating environmental friendliness*	+
Capturing supply chain data and value	*Expanding vertically to capture more value*	+
Service business model does not exist	*Services are a complementary part of the product sales*	++
Service provision	*CompanyA wants to be a solutions provider*	-
Service strategy	*Choosing a clear strategy to follow, experimenting with service concepts*	++
Market risk	*Large technology companies might overtake the market*	-
Big data collection and analysis	*Data analysis tools are lacking*	+-
Consumer trend knowledge	*Adjusting and reacting to emerging consumer trends*	+

5. DISCUSSION

This section synthesizes the interview and literature results and linking previous studies to new information gathered in this thesis. Future development paths are numerous and require careful planning regarding which activities to pursue. Many of them include a gradual upscaling of the service business and expanding to new markets.

This section is divided into parts to highlight the recommendations based on the research question. The first three parts outline different options for the issues that were raised in the previous chapter. These form an answer to the second research question and focus on internal and external drivers of business model changes. In the final sub-chapter, a framework is presented to provide a recommendation and strategic implications of these actions are discussed.

5.1 Enabling data-based service models

From the previous findings, important current internal challenges, that were labeled as either important or very important, were selected to be discussed in this chapter. On one hand, they bring business benefits on their own, on the other, they are required to enable the type of customer service concepts the company seeks to create. These challenges are presented in the table 16 and elaborated further below. Additionally, other related development paths are discussed.

Table 16. *Service orientation adoption challenges and proposed solutions*

Issue	Proposed solution
Process automation	Automating internal processes and current customer facing services
IT integration	Continuing to integrate existing & new systems around a single data storage solution
Outdated systems	Proceeding quickly to substitute outdated systems, enhancing integrations between systems
Logistics optimization	Converting customer demand into production and logistics forecasts
Quality issues	Increase customer feedback channels, production process variable research and raw material procurement development

Use of IT-systems and their interoperability is a critical factor for successful operations as they are the foundation for data-driven service creation. Currently, one of the largest challenges for creating new services based on existing process data and enhancing existing services is the fact that many IT-systems are not interoperable with some being outdated to be used in a meaningful way in the service context. Right steps to that direction have been taken, but there remains the challenge to better orchestrate the internal systems and to ensure that data refinement processes serve the operations and the customers in a productive way. To collect customer data in an efficient manner, the foundation must be solid and enable accurate and to some extent automated data collection processes, for without accurate customer data there is no accurate customer knowledge.

The question of refining and selling the data to third parties does not seem that lucrative option in the light of privacy and other concerns that may raise. However, exchanging data with a third-party company for other important datasets with customer permission would have large benefits for offerings of both companies. Currently most of the established service providers are being very protective of their data. However, with enough customer or other external pressure some of those providers might have to rethink their approach, so the option remains open for now.

In many internal processes, increased customer knowledge brings additional benefits. For logistics, gathering customers' operational data would also prove useful. Capturing slight cost efficiencies in this area could result in a significant competitive advantage, as logistics is one of the largest cost drivers in the industry. Feeding customers' operational data back to own production and logistic processes as suggested by Fleisch (2016) and Monostori et al. (2016) would enable novel ways of operating internally. The rising level of automation would free up human resources for important tasks such as visiting customer sites for better customer service and retaining contacts on a personal level.

On the other hand, own data and product parameters could be made available for the customer to see. For instance, the whole supply chain could be traceable, and the process could be visualized for the customers. Logistics seems the most attainable in short term by better combining customer order history and sensory data to predict demand and logistics needs. Additionally, novel ways of supplying feeds could be created, such as providing warehousing operations as a service with supply monitoring and automatic reorders.

Most lucrative opportunities include combining own sensory data and external data sources to monitor the operation environment in customer premises. Environmental factors are crucial when considering production efficiency and animal safety. In turn, that would help the company experts to guide the customers to choose the right products for

their environment and see, what challenges the current conditions might cause and how to solve them.

By observing the real-world conditions, product development cycles are faster and less prone for errors. In optimal laboratory conditions, some effects of the products may remain unseen or behave differently due to the organic nature of the process. Furthermore, remaining competitive requires precisely targeted or even custom-tailored products for important customers. In many ways, the company could benefit from testing early in real life focus groups in which the results could be instantly seen in data.

Other uses of data in production include better process control and less quality variation. The exact parameters of raw materials could be used to adjust the production even in real time and cutting down on waiting times between batches. Additionally, less material would be wasted for test and adjustment runs. Increased raw material knowledge could provide insight into what kind of parameters to look for and further add to cost savings in procurement. For customers, it would create better quality products and better information even down to the batch level. On the Monostori et al. (2016) maturity scale, the systems are still on the second level of maturity, enabling data collection and analysis through traditional tools. Next steps involve linking production data with raw material quality parameter data and linking that back to customer feedback, making the production process more controllable.

5.2 Transparency and marketing

By gathering accurate production data, the branding and traceability value of that is enormous. The company can provide end customers with accurate data of the origin of the products and their production processes to end customers. In today's world, origin and quality are becoming increasingly important adjectives when talking about food, and the only way to ensure those qualities is to point that out with data (e.g. Linna et al., 2017, Giovannucci et al., 2012) The relevant marketing uses for that data are presented in table 17 below.

Table 17. *Expanding vertically and providing added marketing value*

Challenge	Proposed solution
Capturing supply chain data and value	Providing traceable goods, expanding vertically via digital services
Brand image	Marketing with environmental factors backed up by data
Consumer marketing visibility	Co-marketing products with producers and companies operating in the food supply chain

Other key factor in this regard is environmental friendliness. For end-consumers, environmentally friendly and organic products are part of a global trend for a more sustainable lifestyle. In the future, the environmental impact of agriculture will possibly be measured and restricted through international treaties. The producers must fulfil the terms of those agreements and can do so only by increasing the fidelity of reporting by using better tools to create them. Additionally, they can have larger production quotas by using environmentally friendly products. This not only benefits the producers but also the company, as more and more potential customers could gain interest in the marketing and production value they could gain by using these services and products combined. In addition, these products have a price premium for the profit of the producers.

Currently, the focal company has already campaigns like this, however this part should be emphasized from own marketing to the end-consumer level to gain and to leverage an environmentally friendly brand image across the supply chain. Additionally, such programs would enable better customer retention rates as the certified producers would have use certain products and when considering the international offering, there is without a doubt a demand for a brand like this. Ultimately, there is a synergy benefit in co-branding the products for both the focal company and the producers, as the interests in branding are mutual (e.g. Giovannucci et al., 2012). In foreign and especially developing markets, these kinds of campaigns could possibly have even a greater effect as e.g. in China there have been numerous scandals related to food safety and product forgery (e.g. Li et al., 2018).

5.3 Service offering

The service offering is now a complementary part of the main goods, however, when considering the branding value and potential benefits the services provide, the tables may turn around: goods become the complementary part of the services. When previously a customer would order their feeds based on their previous experience and price only, they could now gain interest by first using the services instead. Products would follow, as they would be made easy to purchase and use through these services, as a larger share of their daily operations would be controlled by the service platform. This phenomenon is noted by Grönroos (2011a), which notes that the supplier's effect on the customer is in fact threefold influencing growth, revenue-generating capacity and cost efficiency. However, if services remain complementary to the products, it might remain difficult to communicate the added value to the customers. As Kindström (2011) noted, capturing the value itself, communicating and visualizing it to customers is as important: short-term and tangible value propositions must be turned around to communicate the long-term value of services to the customers. The proposed actions are presented in table 18.

Table 18. *Service offering development requirements*

Challenge	Proposed solution
Service business models do not exist	Reasonable revenue models must be formed, and value communicated explicitly
Service strategy	A strategy must be formed: how to expand sustainably and cost effectively from pilot phase to production, both in domestic and foreign markets?
Stakeholder relationships	Actively seek the right partnerships and develop them according to the service strategy
Installed equipment	Provide software that functions on a wide range of sensory devices, provide own hardware solutions

Vargo & Lusch (2008) depict that following service logic, customers become a resource for value creation: a process where using one's resources for the benefit of and in conjunction with other parties involved. That is indeed one of the primary goals for the focal company and the current offering is moving to the right direction. However, new initiatives and service possibilities should be devised either on top of the current ones by expanding them or by crafting completely new service experiences. To facilitate growth in services, a solid strategy with a rationale is needed to develop the offering further: how to engage the customers actively and how to enable a dialogue in e.g. product and offering development.

With its ease of use, the customer could focus on the important matters instead of managing storage levels and considering different options for feeds: instead, they could tend to the production environment and animals better. This would further boost their daily production and generate more revenue. For the focal company, this captures a larger share of the value chain and shifts their value proposition, as suggested by Chesbrough (2007b) and enabling a novel way of capturing value. Ultimately, the success of a customer increases their trust, commitment and attraction to the supplier (Grönroos, 2011a).

There is potential for more dialogue between the customers and the company and especially in the co-design and co-development areas, in which new products and service concept could be actively tested with the producers. Customers should be engaged more in a dialogue between the company. Currently, customer contact remains occasional by large and there might be potential feedback to give, yet there are little means to do that. Connecting with the customers through the service platforms would enabled a dialogue and

at least enable an easy way to provide and for the company receive feedback. As suggested by Aarikka-Stenroos & Jaakkola (2012), these mediums can also offer a way to engage in co-creative activities.

Other thoughts on the subject that came up in the interviews was that perhaps the service department should be a separate one altogether. When they would not be so directly connected with the sales as they currently are, down to the person level, so that customers would gain more trust in the services. Decoupling these operations could influence the perceived trust amongst customers, as history has shown that in some cases in other companies, sales have been pushing products to customers that they do not need. In addition to customer trust, ensuring that specialists and service development expertise are under the same roof provides important synergy benefits and signals the importance of service business within company as well (Kindström, 2011).

When planning a service offering that requires the customer to give away their operational data, it must be made clear who retains the ownership to this data and what it is used for. Ideally, customers would give the company access only to the data sources they want to. When co-operating with other companies, a win-win trade should be sought just as with the customers. For new product and service development, customer engagement is vital to understand the needs and challenges in their processes. Experimenting with novel concepts and approaches with key customers provides invaluable first-hand feedback and creates a strong bond between the company and its customers. Third-party partnerships enable interesting options especially regarding co-branding of the products with them and the customers, creating a stronger brand image and promoting company values. The key functions and their relationships are presented in figure 10.

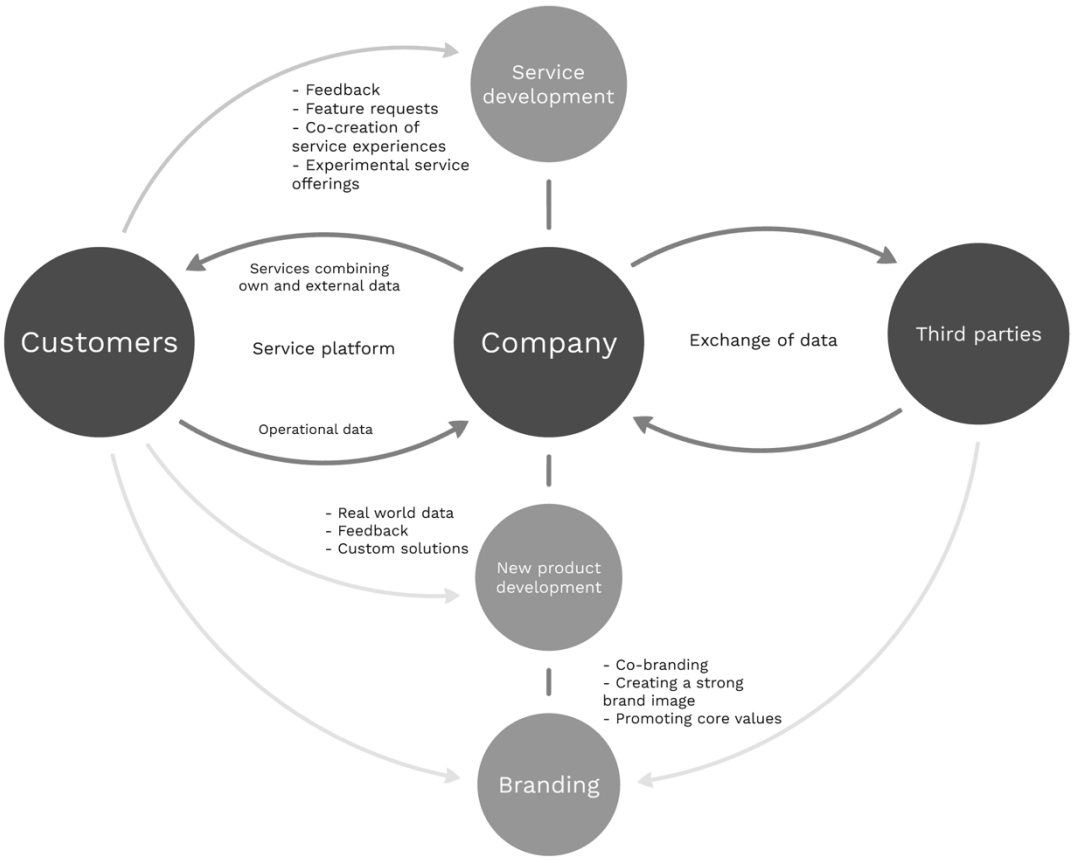

Figure 10. *Service development key functions in the focal company*

5.4 Strategic implications

This chapter discusses the third research question in the context of the case company, which was what kind of risks, opportunities and strategic implications the use of customer data has.

On a strategic level, the company is at the crossroad making the decisions on how to combine the products and services. As the first pilot phase products currently do not generate any revenue, the question remains how to turn that offering into profit. Another implication is to choose, how the products and services complement each other and what is the ratio of the product and the service business. As important a decision is to conclude, how large of a share the company wants to capture especially vertically in the supply chain. Strategically there is a lot of room to maneuver in this regard, as potentially the company could overtake a large share of the customer operations on the supply side, ensuring that the customer has more time for more important tasks. Risks include failing to capture enough value in the supply chain and failing to create required partnerships in doing so.

Collaborating with other equipment manufacturers and creating alliances is an opportunity. Especially interesting are the strategic options for end-consumer marketing and thus creating brand and company awareness outside the regular customer base as well. As the response regarding co-operation from other parties in the industry has been mostly negative, luckily there are possibilities elsewhere. The alliances do not have to be within the industry, as ultimately end-consumers are the most important customers, so efforts should be directed to downstream supply chain and marketing activities for brand and service operation awareness, which is also in the customers' interests as well as something most of them do not have the resources or capabilities for. As suggested by Grönroos & Voima (2013) also within industry marketing can be expanded outside its traditional borders, as a service provider can not only make value propositions but co-create them with the customer. For the focal company, options are illustrated in figure 11.

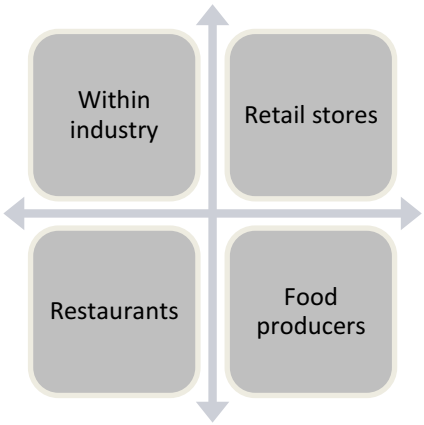

Figure 11. *Expanding marketing efforts with customers outside industry borders*

For forging partnerships within the industry, more visibility and successes may turn the heads of some important companies that despite attempts the focal company has failed to approach. To develop compelling service concepts, having the right partners is important in the long run, as e.g. many service features depend on the data provided by customer equipment, on which the company currently has no influence on. In future, however, important complementary services that function on certain brands may become important for those equipment manufacturers as well, opening new possibilities.

For the company business model, the implications are profound, as the focus shifts increasingly towards services and there is a will to monetize them. Additionally, new types of offering will emerge when combining physical products and cloud services into new and compelling value propositions. When considering international options, there might be only service provision without products to begin with, although expanding offering to

foreign markets can follow in two ways. The first is to collaborate with another manufacturer and use their products in combination with the service platform. Additionally, local expertise is most likely required as the conditions vary from country to country.

5.5 Framework for improving data-based value creation process

In the previous chapter, the identified key findings in the focal company were discussed in detail. Based on those findings, an outline was formed to serve as a guideline for enabling data-based service creation in an industrial company. The created framework answers the main research question.

The empirically grounded framework here aims to present concrete improvement steps applicable to the focal company in order to guide the strategic decisions and lay a foundation for data-based value creation opportunities. The framework is meant to be kept simple and form an outline of the process for expanding into digital value creation and is thus not only applicable to this particular case but also other companies in other industries with modified details.

Currently, one of the largest challenges for creating new services based on existing process data and enhancing existing services is the fact that many IT-systems are not interoperable with some being outdated to be used in a meaningful way in the service context. Additionally, the automation level of own processes needs to be significantly higher than its current state. Second, a strategy for the current service development options needs to be clarified by examining different options and seeking the right partners to do so. Third, no service succeeds without marketing and properly complementing the product offering based on these services. This is also related to the second step, as there is a need to create meaningful solution options for the customers to buy. In the fourth phase, marketing and product portfolio is adjusted to support the service offering. Finally, service business is upscaled and observed to guide the next steps in the service creation process. The whole framework is presented in figure 12.

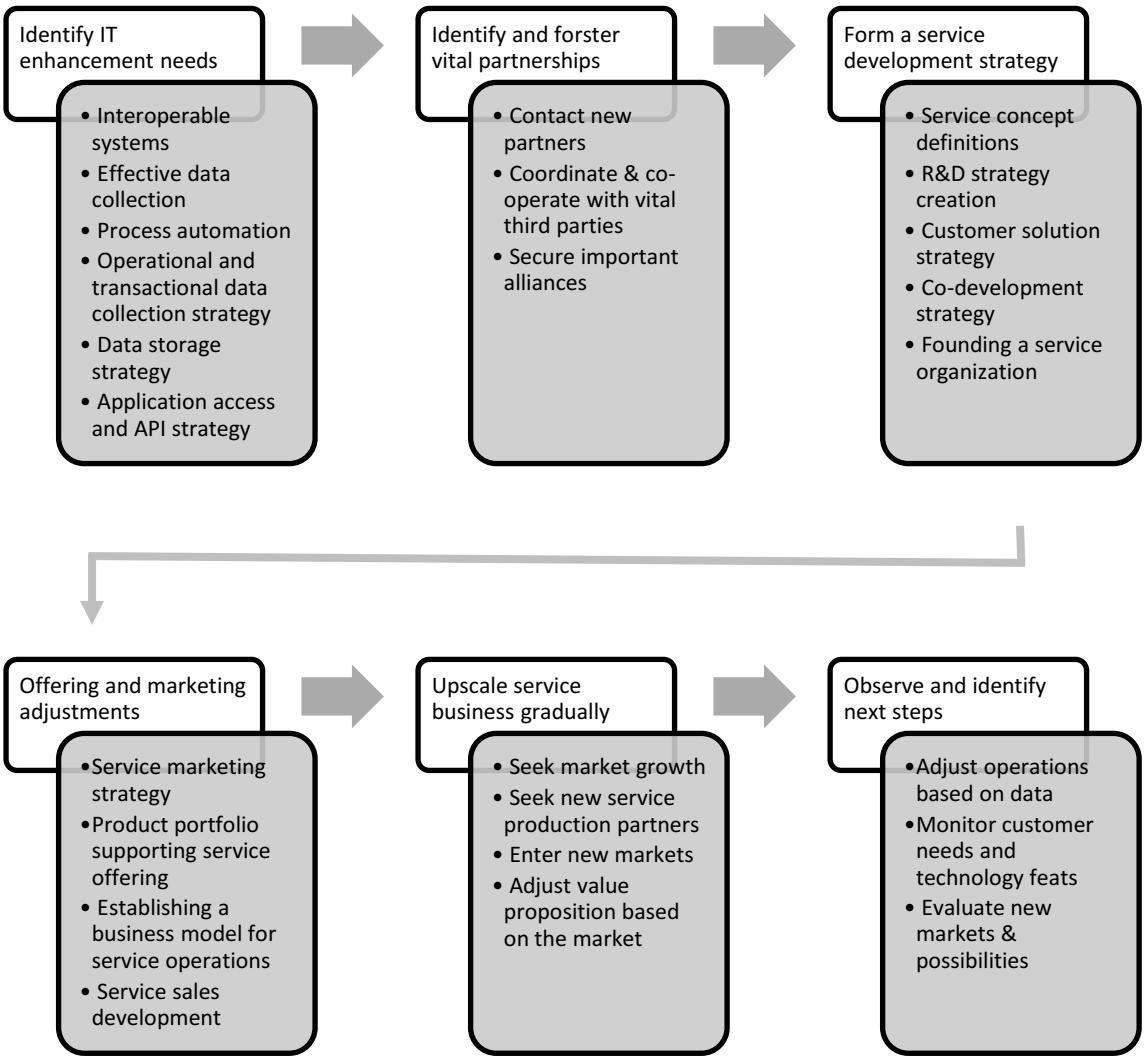

Figure 12. *Framework for enabling data-based service operations*

In the first phase, a foundation is laid to support the data-based service creation processes. Existing and upcoming IT-processes need to be evaluated to support effective data collection, use and system interoperability. Additionally, at the same time, the automation level of different processes must be prioritized. In this phase developments should include an orchestration of data sources as well as both internal and external APIs for those data sources. Although in this case the company is not planning on selling the data or opening a public API, a thought out and well-constructed data storage is an enormous benefit for internal operations and most importantly it is vital for efficient service creation processes. If data points are scattered in the systems far and wide, connections between different systems become problematic to maintain and new ones are substantially more difficult to

add, as they require manual work. Orchestrating data originating from internal and external sources should preferably have a systematic approach and persons solely responsible for those activities. Additionally, and even more importantly with the recent additions to the privacy laws, there is a need to ensure customer data privacy and the right of the customer to delete and download all the data associated with them. Not least because of this all data should be centrally maintained with well documented processes in place to avoid future complications and to enable changing parts of the external systems connected to the company data warehouses.

In the second phase, the most important third parties for service operations must be identified. Additionally, a strategy must be formed on how to build on these partnerships and make them beneficial for both parties. Existing vital processes for service provision should be coordinated and documented in detail especially if that is a vital data source or an operational partner. On the other hand, a backup plan must be formed, should a third-party retreat from the alliance. In the same way, new partners should be approached for creating new mutually beneficial bonds.

Third, a systematic approach for developing services must be formed. There needs to be a consensus on what kind of service concepts to provide and how this offering supports the existing one. Preferably, a service organization is created to ensure that the right people have the enough time and management commitment to develop and produce services. A rigorous service development process should be established, as it greatly differs from the one used in product development with rapid iteration cycles and close customer collaboration. Additionally, interlacing and offering different services as solution packages must be concepted and a roadmap created on how to reach these goals. However, to succeed, there is a need to re-organize the sales process to push the services and make them compelling for the customers to buy. Finally, additional co-development efforts with key customers could potentially bring more out of the research investments, providing invaluable feedback and insight in their operating environment.

After service concepts are mature enough, additional considerations regarding the marketing and product offering are made. Service marketing strategy should support the product offering and complement it whether it will be sold separately, in packages or as solutions. Adjustments to the current product portfolio should be made according to the data collected based on the question what kind of products our customers buy and how do they use them. A functional and sustainable business model for providing services should be created and validated at latest at this stage.

In the fifth phase, service business is gradually upscaled by expanding to new markets and seeking growth in the existing ones. On top of that, seeking additional partners for novel value creation ways and co-production of services should be sought after. Based on the market, new ways of providing and creating value can be tested.

In the final phase and throughout the process, the increased customer knowledge and transactional data collected should be translated into adjustments to product and service offerings. Monitoring latest technology developments and focusing on relevant R&D activities should guide the next steps. As proposed in the figure 10, modes of co-creation and production help in the process of validating new service concepts and enabling continuous feedback from the customers.

6. CONCLUSION

6.1 Meeting research objectives

Creating new value and engaging with customers in new co-creative ways is a constantly evolving topic in research. With new, profoundly different methods of value creation that are enabled by technological advancements such as internet of things and platform economy, value networks and delivery are becoming increasingly complex. Simultaneously the shift from goods towards services modifies business models and offers new marketing opportunities. As in the past the customers were a mere source of money, they are now becoming active counterparts in co-creating value and co-operating in various arenas.

New digital platforms also provide the means to collect and use customer data in novel ways for the benefit of the customer as well as the company itself. Creating digital service platforms further increases the dialogue between a company and its customers, through which increased customer knowledge provides a sustainable competitive advantage hard to imitate. In many ways, the needed adjustments for data-based service orientation and decision making require process changes creating more efficient and novel ways of operating internally as well.

The aim of this thesis was to analyze ways for a company to create new value by utilizing customer data. Secondary goals were to better understand the challenges and the business model adjustments needed to pursue this goal.

The research question was answered through interviews conducted in the case company. Through these interviews, empirical data was collected to analyze the current state of the service business. Furthermore, several development ideas and novel service concept ideas emerged that might benefit the case company.

The main research question was answered in the previous chapter where an empirically grounded framework for digital service development activities was suggested. In that regard, research objectives were met. However, to validate the framework, further interviews and observations in other industries should be made. Additionally, concrete improvement ideas emerged during the interview sessions and were discussed in detail. These improvement ideas concerned internal efficiency, transparency and marketing options as well as service offering development needs.

As for the sub-questions, the focal company's business model will shift from product-based towards a service oriented one solutions provider. Whether that will happen through partnerships and co-creating value or through own service platforms and solu-

tions remains to be decided. These novel means of value creation and shifts in value network were discussed in previous chapter. As for the industry, the dynamics within it are changing and old boundaries are blurring. For the case company, the strategic benefits are clear as it is one of the first among its competitors to actively move towards a more service-oriented company. However, other technology-oriented companies outside the agriculture industry might enter the market.

6.2 Academic contribution and managerial implications

This thesis analyzed new value creation enabled by better understanding the customers' processes by collecting and utilizing the data created by the customers themselves. In this industry context, no previous studies of such kind were conducted. The research was based on the service transformation and value co-creation literature. The focal company's industry offered a different angle to look at the service transformation from the farming point of view.

For the focal company, the service business offers a lot of possibilities and a competitive advantage that other industry incumbents do not have. However, there must be a rationale behind the service offering, its business model and its implications to the company strategy. A technology or capability by itself does not produce returns, but it must be monetized by developing a business model for it. The process of building data-based services is described in the suggested framework in previous chapter. As such, these ideas are transferrable to any industry and could be copied by a competitor. Hence, a competitive advantage cannot be gained through technological feats only but come through the expertise and vision that the strategy has behind it. However, the focal company is in the forefront of the development and tries to combine product and service offerings in a unique way in agriculture industry. Already that provides a significant competitive advantage and unparalleled expertise that e.g. technology companies trying to enter the market do not have.

During the interviews and writing of this thesis, a lot of ideas and development needs emerged. The implications of this kind of a business transformation have widespread effects inside and outside the focal company, which will reshape its business model in the coming years. Particularly important are the implications for marketing and customer communication. However, strategic choices must be made regarding the position of the company in the value network and what kind of partners to seek. Those ideas are discussed in detail in the previous chapter. A framework for developing service concepts and marketing was illustrated to guide the strategic process in the focal company.

6.3 Research limitations

This study was conducted only from the point of view of the focal company and did not assess third party effects on the situation. In future studies and activities concerning this

company, it would be relevant to study the network effects and how the customers perceive such service offerings. As the services are dependent on many external providers, there is a need to analyze the ecosystem and co-creation possibilities within said ecosystem.

The interviews were limited inside the company and did not offer outside expertise nor customer views on the matter. This might be problematic in the sense of customer orientation and understanding customer needs: there might exist unknown on unspoken needs not perceived by the interviewed experts. The same challenge applies to the analysis of the current offering, as there was no primary information gathered from the users. Second hand information was discussed in the form of received customer feedback.

The opinions expressed in the interviews are always subjective, which may pose a problem for the reliability of the study, as the situation assessment is based on the subjective expert views. With a small number of interviews, some views may be more pronounced than others and some themes less discussed and reflected upon, which all comes down to the personal preferences and preoccupations of an interviewee.

Additionally, the interviewees look at the problem from their point of view, which might make it harder to look at the challenges on the company level, not the project, department or business unit level only. In many cases, only one interviewee from each business unit was selected, which may have left some opinions and challenges uncovered.

6.4 Future research

The presented framework for digital service product development cycle needs additional research and validation outside the focal company context. As the value networks and value creation capabilities vary from company to company and industry to industry, some parts of that process may become irrelevant in a different context. On top of that, the framework could be expanded to cover more activities within each step and the tools on how to use them.

Additionally, as the customer base is heterogenous and their needs vary, there is a need to study the various agricultural customer segments and how their needs line with different types of digital service offerings. As noted previously, most of the existing research and current solutions are aimed at industrial scale farming, leaving out the majority of the industry altogether. Moreover, an interesting research topic would be how to engage customers in co-innovating and creating new offerings.

When considering supply chain downstream marketing and co-promotion for end-customers, further studies could be made to elaborate the consumer preference correlation

with perceived brand image, brand awareness and own customers' preferences. Potentially, there is more value to be gained from successful consumer marketing and verified product campaigns than targeting own customers directly, in the focal company context.

Overall, there seems to be little research of data-based technologies, smart farming and its effect on the supply chain and consumer behavior as whole. The use of IoT-technologies and its applications require additional research from the supply chain and consumer point of view. Additionally, researching different supply chain co-operation modes would provide insight into how the agriculture industry is evolving from different entities towards value networks and co-operative business models. As previous research has stated, there is also an identified research gap regarding sustainable business models and governance issues in agricultural context.

When considering value networks, there is a clear need for more research in this domain as the local networks vary a lot from country to country and even in domestic markets. Especially important is to clarify the modes of co-operation and benefits that could bring for the whole value network, such as local food networks and other disruptive means of growing and selling food products.

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APPENDIX A: INTERVIEW TEMPLATE

1. Taustatiedot
    - Kuinka pitkään ja missä tehtävissä olet työskennellyt yhtiössä?
    - Nykyinen toimenkuvasi ja tehtäväsi?

2. Toimiala
    - Millainen on toimialan kilpailutilanne?
        - Mitkä ovat pääkilpailijat?
    - Ajateltaessa datalähtöistä liiketoimintaa
        - Mikä on oleellinen kilpailuedun lähde verrattuna kilpailijoihin tällä hetkellä?
        - Miten vahvuuksien hyödyntäminen näkyy yhtiön strategiassa?
    - Mitä heikkouksia ja haasteita tunnistat datalähtöisen liiketoiminnan kehittämisessä?
    - Minkälaisilla toimenpiteillä datalähtöisessä liiketoiminnassa voisi toimialallanne saavuttaa suuren kilpailuedun?

3. Asiakastieto
    - Mitä palveluita asiakkaille tarjotaan tällä hetkellä?
        - Mikä on em. palvelun markkinatilanne ja liiketoimintamalli?
        - Millaisia palveluita on kehitteillä?
    - Mitä arvokasta tietoa asiakkaista kerätään jo?
        - Miten asiakas- ja transaktiodataa kerätään ja mihin tiedot tallennetaan?
            - Ketkä keräävät näitä tietoja?
            - Missä, miten ja milloin tietoja kerätään?
            - Ovatko kerättävät asiat mielestäsi relevantteja palvelutuotannon näkökulmasta?
                a. Millä tavalla tieto helpottaa työtehtäviä ja asiakkaan liiketoimintaa?
    - Mielipiteesi tiedon ajantasaisuudesta ja päivitystiheyden riittävyydestä?
        - Onko tieto tarvittaessa hyvin saatavilla?
        - Hyödyttääkö tiedonkeruu omaa liiketoimintaa vai myös konsernia laajemmin?

4. Haasteet ja tarpeet
    - Miten tieto asiakkaiden haasteista ja tarpeista välittyy eri tietolähteistä?
        - Millaisia mahdollisuuksia on vastata ilmenneisiin tarpeisiin?
    - Mitkä trendit ja/tai tarpeet ohjaavat tiedonkeruun kehittämistä?
    - Millaiset ovat asiakkaiden teknologiset valmiudet?
        - Miten asiakkaat hyödyntävät eri teknologioita tällä hetkellä?
        - Millaisia datalähteitä asiakkaiden käyttämissä teknologioissa on tällä hetkellä?

        - Millainen on näkemyksesi tulevaisuuden teknologisesta kehityksestä asiakkaiden toimintaympäristössä?
    - Onko olemassa asiakkaiden datalähteitä, joiden hyödyntämisen täyttä potentiaalia ei ole saavutettu?
        - Mitä tai minkä tyyppistä dataa teillä ei vielä ole?
        - Mikä estää tämän tiedon keräämisen?

5. Toimintaympäristö
    - Mitkä yhteistyökumppanit ovat tärkeitä datalähtöisen liiketoiminnan kannalta?
        - Mikä on yhteistyökumppanien rooli tulevaisuudessa?
        - Millaista strategia yhteistyökumppaneiden kanssa toteutetaan?
    - Millainen on teknologian rooli palveluliiketoiminnassa tällä hetkellä?
        - Entä tulevaisuudessa?

6. Sisäiset toimintamallit
    - Teknologia
        - Millaisiin järjestelmiin dataa kerätään?
        - Miten eri lähteistä ja järjestelmistä tuotavaa dataa jatkojalostetaan?
            - Käytetäänkö jatkojalostamisessa automatiikkaa tai tekoälyä?
    - Tuotanto ja omat prosessit
        - Miten omissa prosesseissa muodostuvaa dataa hyödynnetään?
        - Hyödynnetäänkö syntyvää dataa asiakkaiden palveluissa?
        - Vastaavasti, miten asiakkaiden palveluita käyttäessä synnyttämää dataa hyödynnetään?
            - Esimerkiksi tuotannon suunnittelu
        - Kuinka data liikkuu liiketoimintayksiköiden välillä?
    - Tuote- ja palvelukehitys
        - Miten uusien palvelutuotteiden tuotekehitys on järjestetty?
            - Miten datalähtöisiä palveluita halutaan kehittää tulevaisuudessa?
    - Palvelut ja tuotteet
        - Millainen on tuote- ja palveluliiketoiminnan suhde tällä hetkellä?
        - Millainen on palveluliiketoiminnan rooli tulevaisuudessa?
        - Harkintaanko datan avaamista ja myynti kolmansille osapuolille?
            - Millaisia kumppanuuksia haetaan tulevaisuudessa?

7. Muuta
    - Onko jotain muuta, mitä haluaisit kertoa datalähtöiseen liiketoimintaan liittyen?